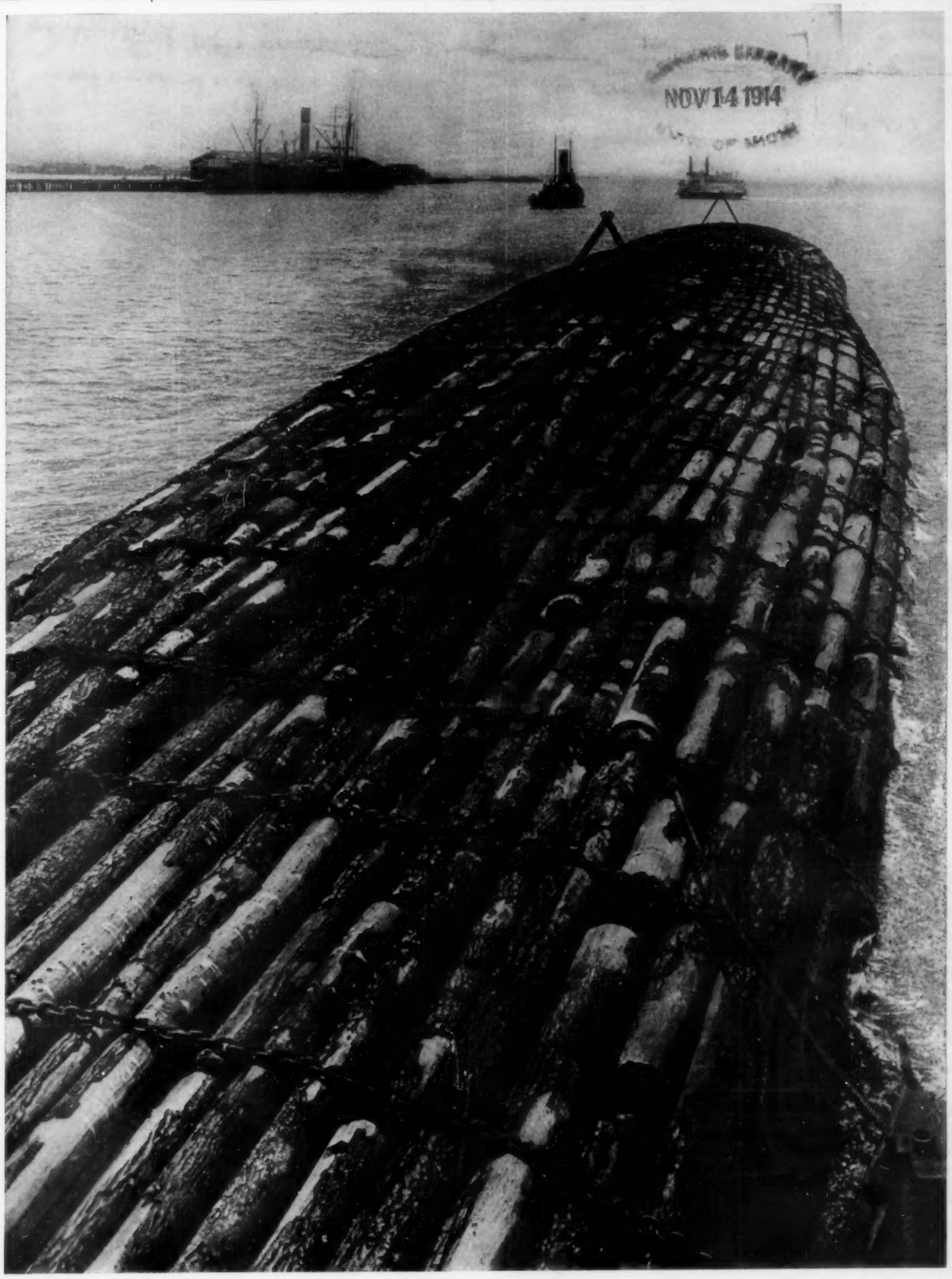
SCIENTIFIC AMERICAN



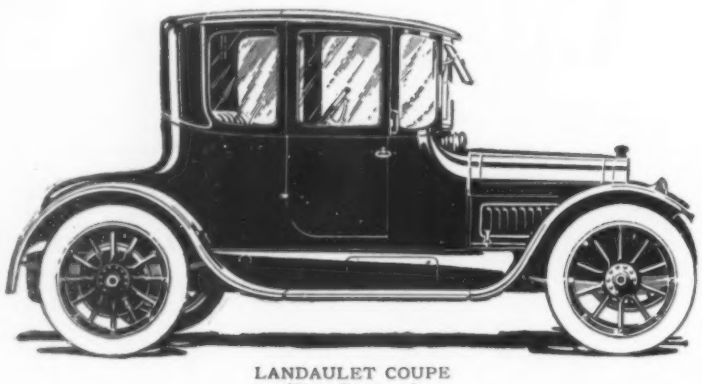
A GREAT OCEAN-GOING RAFT.

Vol. CXI. No. 20
November 14, 1914

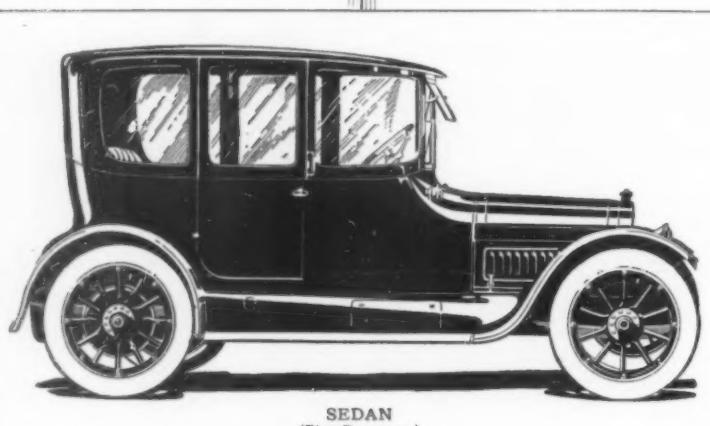
Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents
$3.00 A Year

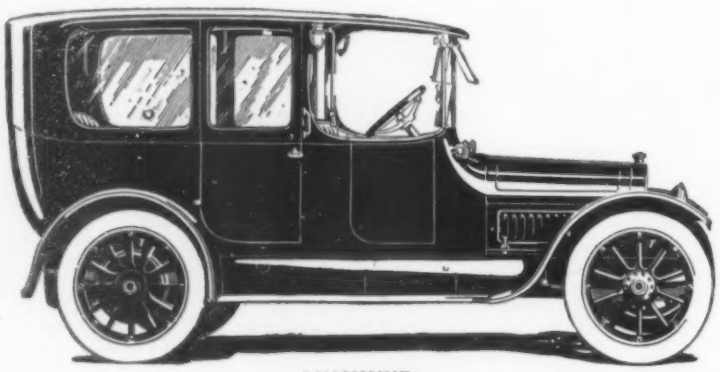
Cadillac
Standard of the World



LANDAULET COUPE
(Three Passenger)
$2500 F. O. B. Detroit



SEDAN
(Five Passenger)
$2800 F. O. B. Detroit



LIMOUSINE
(Seven Passenger)
$3450 F. O. B. Detroit

CADILLAC ENCLOSED CARS

Here is provided the harmonious blending of the highest engineering achievement with the utmost in designing art and coach building skill.

The engineers have provided an eight-cylinder motor of superlative smoothness. The coach builders have provided a dignified and luxurious environment.

The liquid smoothness of these cars is supplemented by a sense of complete seclusion; the seclusion by a sense of rest and relaxation; the restfulness by a sense of unexampled ease and elegance.

Buoyant springs, deep soft upholstery. appointments in quiet good taste but still almost palatial—all of these soothing influences bring supreme comfort to mind and body, and leave you almost oblivious to the fact that you are borne along by mechanical means.

Special Enclosed Car Booklet on Request

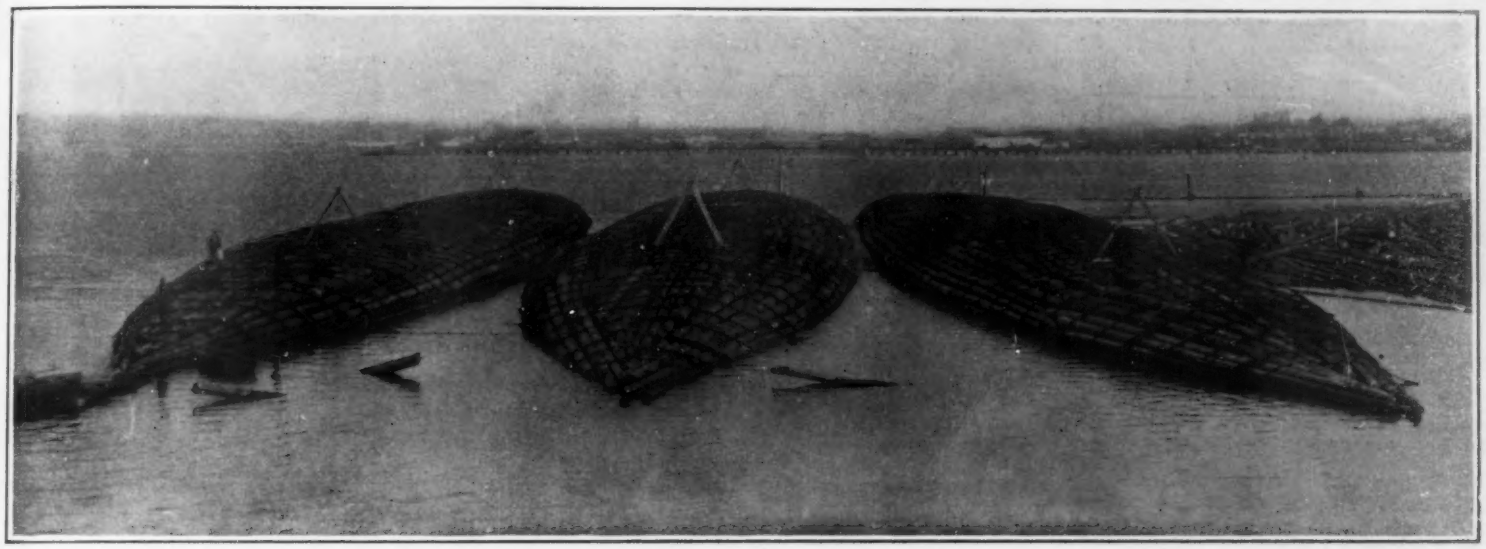
Cadillac Motor Car Co. Detroit, Mich.

SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXI. NUMBER 20.] NEW YORK, NOVEMBER 14, 1914 [10 CENTS A COPY $3.00 A YEAR



Three great ocean-going lumber rafts in San Diego harbor.

Ocean-going Log Rafts

By J. F. Springer

ONE of the large industrial problems of the times is the transportation of raw material. Such material is often in almost inaccessible situations, and sometimes also far away from the manufacturing point. Thus in the case of timber logs, they will often be cut far up on the mountain side, or in a swamp or exceedingly distant from the sawmill. A partial solution of the problem, but one which fits only some of the cases, is obtained by building the mill in the vicinity of the cutting or in using a portable one. But the demand for lumber fluctuates greatly; so that if cutting is to go on continuously there will be accumulations of boards and other sawed products. Such accumulations involve investments of capital which may be very undesirable. The freight rates by rail and boat are apt to be very considerable, especially where the distance is long.

Impelled, no doubt, by considerations such as these, Capt. H. R. Robertson undertook thirty years ago to construct a raft of logs in Nova Scotia, and then to bring it to New York in care of a towing tug. Apparently, this raft was the first ever constructed with a view to ocean navigation. The general idea of rafting logs was not a new one. But it had only been applied, so far as is known, to cases where the route lay through inland waters. A framework was set up on the shore near Pictou, Nova Scotia, by Capt. Robertson, and by its means a great bundle of logs was constructed. This was the raft, but it was still on the land. After a good deal of difficult work, the unwieldy mass was at last gotten into the water, and the journey toward New York begun. The tug in charge got it out to sea and some distance on the way, when a shortage of coal arose. So the tug went into port for the needed fuel. When this was obtained and the tug got back, the raft was nowhere to be seen. In fact, no one seems to have located it then or afterward, until at last it was discovered on the other side of the Atlantic Ocean on the Norwegian coast. This experience proved that Capt. Robertson's main idea was right; it *was* possible to bundle a lot of logs together in such shape as to make a seaworthy mass. And this was a great deal.

Another thing was shown by this effort. It was inadvisable to build on shore, unless some method of launching could be provided. Capt. Robertson went to the Pacific Coast, and there carried out the idea of constructing the rafts in the water. A floating cradle was rigged and used as a guide or holder in forming the raft. At Coos Bay, along the Pacific boundary of Oregon, two rafts were built with floating cradles. But a submarine bar made difficult or uncertain the getting of the deep floating masses of logs out to sea. So, Capt. Robertson now transferred his operations to Coal Creek. Here rafts are still built and floated out to sea *via* the Columbia River. They are towed down the coast to San Francisco—a distance on the sea of 500 or 600 miles. The material that is brought to San Francisco in this way consists only of timbers suitable for piles.

Capt. Robertson's ideas seem to have appealed to Mr. S. Benson, a large owner of standing timber in the neighborhood of Wallace Slough; for about 1906, we find him making efforts to employ ocean rafting in order to get his timber to market. At that time, the freight rate to San Diego, California, was about $10 per thousand board feet. This was one incentive. Another consisted in the fact that rafts would enable sales to be made of lower grade material that would otherwise be largely waste. A third incentive lay in the possibility of manufacturing the timber into lumber at San Diego in such manner as to provide for the reasonable demands of the market, and yet not involve tying up a large amount of capital. Mr. Benson's plans have been carried out with success. Twenty-nine ocean-going rafts have successfully been brought into the harbor at San Diego. There has been no loss, no trouble. In most cases, not a single log has worked loose.

The Robertson system as carried out practically for Mr. Benson by Mr. O. J. Evenson is as follows:

Heavy timbers, each 12 by 20 inches in cross-section and 24 feet long, form the uprights of the floating cradle. The cross bar timbers are much lighter, being 6 by 12 inches in section. The bottom of the cradle is constructed in sections that may be pulled apart when the logs have been secured together. During the construction of the raft, the sections are held together by means of a key piece. The logs are floated to the cradle and the raft built up from the bottom. When about half the logs are in place, an enormous chain made from 2½-inch steel is laid along the axis. Seven herring-bone chains connect the center chain with the ends of the raft. The logs employed for the outer part of the raft are those which are the longest and most pliable. The butt ends are put nearer the amidship portion of the raft, and thus assist in giving the whole a cigar taper at either end. Chains are used to encircle the body of the raft and hold it together. The interior is filled up with logs of miscellaneous lengths. The outside logs will be 50 or 60 feet long, and the raft itself will have a length somewhere in the neighborhood of 700 feet. The various herring-bone chains run diagonally to the cigar tapers and are there secured to the encircling chains. The arrangement of chains combined with the general form of the raft and the method of placing the exterior logs results in a secure bundle. The encircling chains will not work toward the ends because of the herring-bone chains. There is a distribution of the pulling effort of the central chains, when the latter is hauled ahead by the towing chain, that makes for security. There is also a certain amount of slackness of the chain arrangement amidships which conduces to a slight response of the raft to the waves. The herring-bone and the encircling chains are made from 1¾-inch steel. The latter go all the way round, and are placed at intervals of 12 feet. The central chain extends beyond the ends of the raft at either end. Altogether, the chains on a single raft weigh, with attachments, somewhere about 115 tons and have a value in the neighborhood of $10,000. These figures are for a 700-foot raft. They are built even larger. The thickness of a typical raft is about 30 feet, and its breadth amidships, 55 feet or thereabouts. The tapered portions occupy each about 100 feet of the total length. The amount of timber contained in it will run from 4,000,000 to 5,000,000 board feet. It will sink into the water until about one third of its height is above. A 1,200-mile tow into San Diego costs about $1 per 1,000 feet. The cradle may, of course, be used over and over again. Its first cost is about $5,000. To handle the logs that are to go into the raft, a floating derrick or its equivalent is required.

As such a raft is in effect a boat or barge containing a cargo of timber, it is not at all essential that the interior logs should themselves be suitable for the ordinary methods of logging in which the logs are expected to float. All kinds of timber may be put on the inside—heavy logs, semi-refuse, and so on.

That the development of an economical method for the transportation of raw material may result in a large gain widely distributed may be learned from the recent history of San Diego. Prior to the coming of the first raft into the harbor in 1906, lumber was locally sold as high as the prices associated with a $30 base. In a few months, however, the base was down to $17. This reduction applied to the market generally and not simply to the customers of one or two sellers. San Diego has used upward of half a million board feet in the past eight years. Estimating the average saving per 1,000 feet to have been $8, we have a total benefit of $4,000,000 spread over the entire community.

A somewhat similar system is sometimes adopted in the Coastal Plain of the East, where the logs are brought from the point of origin to a log dump on tidal water. A steel cable or heavy chain will be secured by one end to the trestlework of the railway. The other end is carried up to the second story of the dump structure, where it may be let out or drawn in by a winch. A loop will be formed in this way for the reception of logs dropped from the railway. Two such loops form a cradle. In addition, two binding chains are arranged to hang in the water with the loops, one chain with either loop. One end of a binding chain is for the time being secured to the unloading dock, while the other is attached to a small rope which extends outside the cradle. When a complement of logs—from 20 to 30—is in the cradle, the cradle cables are drawn in by the hoisting device with the object of causing the logs to settle together and form a compact bundle. The binding chains will now be recovered by means of the small ropes, and the bundle securely tied up, heavy iron dogs being used to assist this matter.

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, NOVEMBER 14, 1914

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary
Orson D. Munn, Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Entered as Second Class Mail Matter at the Post Office Department, Ottawa, Canada.
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year $3.00
Postage prepaid in United States and possessions. Mexico, Cuba, and Panama
Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid 5.75

The Scientific American Publications

Scientific American (established 1845) ..... per year, $3.00
Scientific American Supplement established 1876. " " 5.00
American Homes and Gardens ..... " " 5.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application
Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

On the Mat

THE aeroplane, the automobile, and the strategic railway, in co-operation with the enormous hosts which comprise modern armies, have resulted in transferring modern battles from the prize ring (if we may be pardoned the phraseology) to the wrestling mat. The armies of to-day are so vast, so wonderfully mobile, and have such intimate and accurate knowledge of each other's intended movements, that the strategy of Napoleon and von Moltke lives only in history and in the military manuals.

Given an army of sufficient numerical strength to maintain an adequately manned and unbroken front between two flanks which are based upon geographical or political positions which cannot be turned or outflanked, and given in each army equal courage, endurance and generalship, and we find conditions of warfare which result in what is practically an *impasse* or stalemate.

Such is the condition on the three hundred mile battle-line in France and Belgium to-day. So great are the combined numbers of the opposing forces, totaling probably some four and a half million men, that the whole three hundred miles, more or less, extending from the English Channel to the Swiss frontier, is held (or could be held if the troops were evenly distributed) by an average of seven thousand men to the mile on each side. Everywhere the troops have so completely "dug themselves in," and the line, as thus held, supported by rapid-fire field guns, machine guns, and heavy siege artillery, is so impregnable, that the fiercest attacks of that wonderful military machine, the German army, delivered, as they have been, with matchless bravery and indomitable persistence, have failed to break through with sufficient force to bring about a decisive result.

In the earlier phases of this stupendous conflict the various military experts, detailed to unravel the complicated strategy and maneuvers of war for the intelligent reading of the layman, made frequent use of the old phraseology of the books, and we heard much about "driving a wedge," "flanking movements," "rolling up the enemy's forces" and "enveloping him with a ring of steel," and about the possibility of a "second and greater Sedan." Yet nothing of the kind has happened.

The theories of strategy and tactics are the same, but the developments in the modern instruments of war and the vast scale on which the conflict is being waged have rendered the successful application of these theories impossible. When the Allies, a few weeks ago, determined to turn the right flank of the German forces, and depleting for the time being the strength of their center and of their southern line, began to move troops to the northwest and brought up reserves for joint action with these troops in a great turning movement, the German aeroplane scouts were able to judge from the movements of the trains, automobiles, and transport the direction of the movement and its magnitude. The German generals, profiting by this aerial reconnaissance, and using the excellent railway service and the vast automobile transit at their command, were able to concentrate sufficient troops on their right flank to meet and stop the turning movement. Conversely, when the Germans concentrated, let us say, at their center, in an effort to break through the allied lines, they found the enemy massed in sufficient strength at the point of contact, either to hold the line intact or, if it were pushed back, to make a heavy counter attack and rob the movement of any definite practical results.

At least under such conditions as exist in the western theater of this gigantic conflict, it must be admitted that the days of Napoleonic strategy are over. The swift action of the prize ring has given place to the slow wrenching and twisting of a pair of heavy-muscled giants upon the wrestling mat; and it begins to look as though the fight would be won by the sheer exhaustion of one or other of the two great armies which are writhing in a close-locked embrace, all the way from the waters of the Channel to the mountains of the Swiss frontier.

It is perfectly conceivable that if the great Napoleon himself were alive to-day and were in command of one of the French armies, we should hear no more of his particular work than we do of that of any one of the French generals who are so successfully holding the German army at bay.

German Patents and Trade-marks in England

SOON after the declaration of war an act was passed by the British Parliament granting to the Board of Trade temporary powers to order, on the application of a person interested and after due inquiry, the avoidance or suspension of patents, designs, and trade-marks owned by the subjects of a state at war with Great Britain. In two months about one hundred applications were received from British business men asking for permission to make products protected by English patents granted to Germans, and about the same number of applications for the right to use German trade-marks which have been widely advertised in England.

In justice to the British authorities, it must be stated that these applications will be granted not for the mere asking, but only after due cause has been shown. Nor are the patents themselves to be revoked or confiscated. The general plan seems to be the granting of licenses and the payment of royalties to the British government during the continuance of the licenses. The continuance of the license after the war will probably be made subject to a royalty payable to the patentees.

The losses that German manufacturers and merchants will sustain by this procedure cannot be calculated. One well-known firm of English chemists has applied for the right to manufacture "Salvarsan" in England under the patent granted to Messrs. Meister, Lucius and Brüning of Frankfort. Other applications affect German patents for the making of artificial teeth and the manufacture of electric igniters for explosion motors. At least one hundred of the more valuable patented products which Germans have developed only after the most painstaking research and the expenditure of vast sums are likely to be made by British firms who have contributed in their development not one whit of intellectual effort or a single penny in money.

The situation in trade-marks is equally serious. Thus the valuable trade-mark "Pebeco" for a tooth paste manufactured by Beiersdorf & Co. of Hamburg, the mark "Aspirin," the name of a well-known drug manufactured by Bayer & Co. of Germany; the trade name "Formamint," owned by von Wulfing of Berlin, and other marks, made priceless by sound business methods, are likely to appear upon British equivalents.

No wonder that the German technical periodicals contend that this procedure is additional evidence of England's commercial jealousy. Such contentions are, of course, absurd. On the other hand, no more telling proof of German manufacturing ability and German business enterprise could possibly be obtained than this piracy, this permissible infringement, under the guise of law. The Comptroller-General of Patents seems to have realized this.

"Why do you say they have obtained this large reputation?" he asked the lawyer representing the firm of English manufacturing chemists who applied for the right to use the trade-mark "Pebeco." "Is it because they have taken greater trouble to push their goods while British manufacturers do nothing? One has found it over and over again during the few days one has been sitting here that British manufacturers say 'We can supply goods equally good, but the sale is not so large.'"

To which the lawyer frankly replied: "It is because they have not been so energetic as the Germans."

After this avowal the act itself reads almost like a ridiculous pretext for seizing the fruits of German science and business enterprise. The applicant merely has to prove that the patent is held by an alien enemy, that he himself intends to work the invention in the British realm, and that it is to the general interest of the country or a section of the community or of the trades that the patent shall be so worked in Great Britain. The door is open for the practice of frauds upon the public, no matter how carefully the Comptroller-General carries out his intention of granting applications not merely for trade-marks, but only for trade names which alone identify articles.

That Germans and other "alien enemies" of England will retaliate in kind is to be expected, and their form of retaliation will probably be no more commendable than the British act. War is indeed a splendid device for bringing out commercial pettiness. Sound business cannot be built on the moral principle which legalizes such robbery.

Baltic Ice and the War

THE Russians have a saying that General January and General February are their best allies in the task of defending the Czar's empire. This saying, of course, calls to mind, first of all, the hardships inflicted upon invading armies by the rigorous Russian winter, as during the retreat of Napoleon's grand army from Moscow, and again during the winter campaigns of the Crimean War.

The situation with respect to naval warfare is, however, complicated by the fact that while many European ports are made inaccessible to an enemy by ice during the cold season, the same ice tends to immobilize the Russian fleet. Thus the advantage gained in defense is offset by a diminution in the powers of offense. These conditions must be reckoned with in the present war.

At this writing the German fleet and coast are threatened by the naval forces of Russia in the battle of the Baltic and those of Great Britain in the North Sea. To what extent this will be true during the winter will depend somewhat upon whether the season proves to be mild or severe. In the North Sea ice never offers a serious obstruction to steam navigation except—and then rarely—along the coasts and in the mouths of rivers. In the Baltic, much of the sea is choked by ice every winter, though conditions vary immensely from year to year and from place to place. Entrance to the principal ports, except in the extreme north, is, however, facilitated by the use of ice-breakers. Thus even in the Gulf of Finland, in March, 1899, the ice-breaker "Ermack" steamed through fixed ice, two to three feet in thickness, at the rate of six to eight knots, from the meridian of Reval to St. Petersburg, making a channel of her own width 160 miles long. Hence, of the two great Russian naval ports on the Baltic, Kronstadt can be kept open during at least a part of the nominally closed season by artificial means, while Libau is naturally ice-free except in winters of most unusual severity. One of these exceptional cases was the winter of 1892-93, when Libau was closed to navigation from January 16th to March 18th. All the German Baltic ports are easily kept open to steamers by the use of ice-breakers when necessary.

The Cruiser Fight in the Pacific

OUR illustration of last week, showing the fleet of ships of the Allies which had been sunk by the German navy, was completed before the news arrived of the recent German naval victory in the Pacific, and hence the British ships which were sunk or disabled by German gunfire in this engagement were not included. The fight, which took place off the Chilean coast as night was coming on, was a most dramatic one—short, sharp, and decisive. At the present writing, the only details of the engagement are those which have come from German sources, the British Admiralty announcing that it has not as yet received any official accounts of the disaster. Although the British squadron was outnumbered in the proportion of five warships to three, and was greatly outmatched in the number of armor-piercing guns carried, namely, sixteen to two, this does not detract from the great credit which is due the German admiral for having concentrated the widely-scattered German vessels in the Pacific into a compact squadron, and having so maneuvered as to engage the British forces with an overwhelming superiority. The difficulty of this feat will be appreciated, when it is borne in mind that the Germans have no coaling bases available in the Pacific, and that they are under the necessity of replenishing their stores of fuel and supplies during limited visits to such neutral ports as may be available.

According to the German reports, the engagement opened at long range, according to first accounts about 9,000 yards, the ships drawing in to about 4,500 yards at the close of the fight. The British squadron consisted of the armored cruiser "Good Hope" of 14,000 tons, carrying two 9.2-inch and sixteen 6-inch guns, and "Monmouth" of 9,800 tons carrying fourteen 6-inch guns, and the protected cruiser "Glasgow" of 4,800 tons mounting two 6-inch and ten 4-inch guns.

On the German side were five vessels, the armored cruisers "Scharnhorst" and "Gneisenau," of 11,600 tons and each carrying eight 8.2-inch and six 6-inch guns, and the protected cruisers "Nurnberg," "Leipzig," and "Bremen," mounting between them thirty 4.1-inch guns. The German armored cruisers concentrated their broadside of twelve 8.2-inch guns on the "Good Hope," and she was quickly put out of action. The "Monmouth" interposed, and her 4-inch side armor was easily penetrated, and the ship sent to the bottom. The "Glasgow" and the transport "Otranto" escaped, but have not been since reported. The "Scharnhorst," "Gneisenau," and "Nurnberg," put into Valparaiso, but the whereabouts of the "Leipzig" and "Bremen" is still in doubt.

Engineering

Modernizing Alexandria, Egypt.—The municipality of Alexandria, Egypt, has decided upon a modern drainage system for that city. The work will comprise a general system of sewers, a pumping station at Kaid Bey, and a main outfall to the sea.

Metal Railway Ties in Switzerland.—Metal ties were first used in Switzerland in 1881, since which time they have replaced to a large extent the wooden tie. About 70 per cent of the ties used by the Federal Swiss Railway System are of metal. These ties are 9 feet by 9¼ by 5¼ inches, weighing 160 pounds, and selling for $2.30 against $1.25 to $1.50 for oak ties. German iron foundries have formerly supplied the metal ties.

Large Profits from Small Products.—Knitting machine needles furnished the United States from Saxony last year were valued at $138,000. The largest knitting-machine factory in Chemnitz aggregated $2,856,000 in needles and machines, and since its formation in 1889 its sales have amounted to $23,000,000. This company has declared dividends for the last three years amounting to 20 per cent, 24 per cent and 27 per cent.

Radio Telegraph and Telephone in India.—New radio offices were opened at Karachi and Butcher Island, Bombay, with a working range of 600 miles, over 2,000 miles of line and 11,000 miles of wires and cable; and 183 telephone exchanges were established in India last year. The telephone lines at Delhi and Simla were also placed underground. Nearly 16,000,000 telegrams provided a gross revenue of over $5,000,000.

Hydro-electric Power for Swedish Railways.—Until the government built its large plant at Trollhatten, all the hydro-electric plants in Sweden were owned as private enterprises. The government has two other large plants under construction at Daleff and Porjus in Lapland, which as soon as completed will furnish the power for the state railways in northern Sweden. The water falls of Sweden have been calculated to contain 6,000,000 horse-power. About 16 per cent is utilized at present.

Increasing Output of Japanese Mines.—With the introduction of modern machinery, the output of the mines of Japan have increased in value in ten years from $28,500,000 to $66,000,000. The Nagasaki district the most important, has shown a steady growth in its output of coal, copper, zinc, gold and silver. The production of coal has increased rapidly with a demand for Japanese coal in all the ports of the Orient. This demand has extended to the west coast of America, over $500,000 worth having reached San Francisco this year.

Ball Bearings in Sweden Remunerative.—The leading manufacturer of ball-bearings in Sweden, Aktiebolaget Kullagerfabriken, with a plant at Goteburg and branches in France, Germany, Denmark, England and the United States, has declared a dividend of 15 per cent on its capital stock of $1,600,000 and has increased the capital stock to over $3,000,000. It is said on good authority that the dividend required less than one half of the net earnings. The state railways have recently decided to use ball-bearings on all their rolling stock. The state railways of Sweden are progressive. Though the private lines have a mileage of double that of the state lines the gross income last year on the private lines did not equal that of the state lines.

New Roads in Ecuador.—There is but one completed railroad in Ecuador, that between Guayaquil and Quito. Until this road was extended in 1905 Quito was, by modern standards, considered to be shut out from the world. Another road, the Ambato-to-Curaray Railway, 190 miles long, is under construction which will connect the Guayaquil and Quito Railway at Ambato with the easterly provinces of the republic. The last consignment of rails for this new road is expected about November. Two Baldwin locomotives have been received and other rolling stock has been ordered from the United States. The preliminary survey is nearly completed for still another railroad between Puerto Bolivar and Borja known as the trans-Amazon Railway. This road will connect the Pacific coast with the head of navigation on the Maranon River, the name by which the upper Amazon is known as it passes through the Peruvian Andes within a hundred miles of the Pacific Ocean.

Grain Docks and Floating Elevators at Antwerp.—The "dock of concentration" at Antwerp was, by the action of the city authorities just prior to the declaration of war, to have been a reality in 1916. The plan, conceived ten years ago, is to concentrate at one great dock all the grain barges which serve as warehouses, and the floating elevators which furnish the business to Antwerp's 300 grain houses. These elevators, with eight new ones voted last year, are twelve in number and are owned by the municipality. They are pneumatic with a lift of 100 feet and one cares for a cargo of 5,000 tons in about three days which formerly detained a vessel there for fourteen days when hand labor was employed. While hostilities may perhaps set the work back another decade, hope may be derived by Antwerp and other stricken cities by remembering how calamity often has a most stimulating effect upon industry—as in such notable cases as San Francisco, Baltimore, etc.

Science

A School of Colonial Agriculture has been established at S. Ilario Ligure, Italy, by the Italian Ministry of Agriculture. A three-year course will train students for practical farming in the Italian colonies.

Atmospheric Air and Tuberculosis.—One of the prize papers presented in connection with the tuberculosis congress in Washington was that by Dr. Guy Hinsdale on Atmospheric Air and its Relation to Tuberculosis. This paper has been printed and issued by the Smithsonian Institution.

The Development of Heat by Plants in Dewar flasks has been studied recently by H. Molisch. The flowers, leaves, and fruits of a large number of plants showed great contrasts in the amount of heat developed. Most leaves and flowers developed considerable heat; mosses, algæ, and a number of common fruits, very little. Lichens and fungi showed a wide range in this respect.

Prof. Hermann J. Klein, who died last summer at Cologne, Germany, was well known for his popular writings on astronomy and meteorology; also as the editor of the journals *Sirius* and *Gaea*, and the annual publication called *Jahrbuch der Astronomie und Geophysik*. Among his voluminous works the one that is probably most highly esteemed in England and America is his "Star Atlas" (English translation by McClure).

Technical Meetings and the War.—The war has entirely upset the programmes arranged by the various English engineering socities for this fall, and most of them have had to be postponed indefinitely, such as that of the Iron and Steel Institute, which was to have been held in Paris on September 21st, and the Institute of Metals that was scheduled at Portsmouth on September 10th. The Institution of Mining Engineers was held as usual.

German Scientists in Australia.—A number of distinguished German scientific men who recently went to Australia to attend the meeting of the British Association for the Advancement of Science have been interned in that country by the Commonwealth government on account of the war. They will, of course, receive the best of treatment during their nominal imprisonment. They have been supplied with ample funds by the treasurer of the British Association.

An Interesting Example of the Brocken Specter was recently described by Sir Thomas Holdich at a meeting of the Royal Geographical Society. It appears that there is a mountain called Omi on the borders of China and Tibet, where it was claimed that the devout worshiper might occasionally see, from the summit, the image of his great teacher Buddha approaching the mountain. This belief was recorded as a mere idle superstition by explorers, until one of the latter happened to ascend the mountain under suitable atmospheric conditions and saw his own, apparently colossal, shadow cast by the sun upon a bank of fog; in short, the well-known specter of the Brocken.

Portraits in Colors.—A new process is now announced which it is claimed gives remarkably perfect results, and is simple enough for practical commercial purposes, although not suited for amateur work. This process is stated to be a modification of the Ives three-color process, except that only two colors are used, red and green. Two negatives are taken in a special camera, or in a regular camera using color screens. These negatives are so treated with dyes that the coloring matter replaces the silver in the film, and the plate becomes its own positive. The two plates are superimposed, and mounted in a frame so constructed that an electric light may be placed behind the picture, which is to be viewed by transmitted light. This process has been perfected by Dr. C. E. Kenneth Mees, a physicist connected with the research laboratories of the Eastman Kodak Company, with the assistance of Mr. John G. Catstaff, and is claimed to give remarkably faithful reproductions of colors, features and fabrics in protrait work.

Observing the Eclipse in Russia.—One of the expeditions to Europe to observe the recent eclipse of the sun was made by Prof. David Todd, of Amherst College. Arriving at Libau, Russia, he found that in the neighborhood of forty other parties were located at Riga, the nearest point in the path of the eclipse, so he decided to try some other place. Through the chief observer of the Imperial Observatory, at Petrograd, he received an invitation to make his observations at a private estate near Kiev, but his host was called away by the mobilization of the troops, and Prof. Todd accepted the invitation of another gentleman at Semla, a hundred miles south. As rail transportation was disorganized, Prof. Todd's instruments were delayed and did not reach him until too late to unpack and set up, but in the meantime he secured a very good lens in Kiev, with which he arranged a photographic apparatus, and he secured some photographs showing the solar corona quite plainly, although conditions were far from favorable, as a bank of clouds extended over that section of Russia during the eclipse, while the other points of observation enjoyed a clear sky. After his work was completed, Prof. Todd had some difficulty in getting out of the country.

Inventions

A Tramping Packer for Silos.—George C. Park of Anadarko, Okla., in patent No. 1,111,610, shows a packer suspended within a silo and which can be raised and lowered and rotated to pack with a tramping action at any point within the silo as the filling of same proceeds.

An Aeroplane with a Safety Plane.—Philip H. Smith of Pawling, N. Y., has obtained patent No. 1,110,355 for an aeroplane which has an auxiliary safety plane capable of release and independent action as related to the main plane and designed to prevent precipitate descent in the event of motor failure or other mishap.

An Edison Sound Modifier.—In patent No. 1,110,382, issued upon the invention of Thomas A. Edison, the sound conveyer of a phonograph is provided with a spherical sound modifier together with means for adjusting the modifier back and forth into different positions within the conveyer; the means including a rotatable bobbin and a returning spring.

A Tell-Tale for Bottles.—Charles J. Canda of Elizabeth, N. J., in patent No. 1,110,886, shows a tell-tale for bottles which is located in the bottle neck below the closure and is of such material that when it is considerably deformed, as would be the case in pushing it down for dispensing the contents of the bottle, it cannot be brought back into its approximate original shape.

Utilizing Talking Machine as a Burglar Alarm.—Patent No. 1,111,190, to Axel Stahl of Chicago, provides a talking machine which is started to give an alarm in the event of a window or door being opened by an intruder. It offers vast opportunities in the selection of exclamations and phrases designed to frighten away the would-be burglar.

A Canal Zone Aerial Life Saver.—In patent No. 1,110,710, to David Williams Ogilvie of Balboa, Canal Zone, is shown a life-saving device for aeronauts in which reversely related parachutes are secured to the garment at substantially the waist line thereof and suitably stayed from the garment, one parachute coming into play if the aeronaut falls head first and the other if he falls feet first.

A Stabilized Flying Machine.—Patent No. 1,111,627, to James L. Walker of Grand Island, Neb., seeks to provide a novel construction of flying machine of the aeroplane class which possesses both inherent and automatic stability, and which under ordinary conditions, when its balance is disturbed, will of its own volition adjust itself for the action of the air to return it to balanced position.

Seeks a Resilient Railroad Tie.—Seeking to provide a durable and resilient railroad tie, George H. Hardman of Fall River, Mass., has secured patent No. 1,110,684 for a railroad tie composed of small trees, saplings or branches and an asphalt binder placed in a mold and pressed to the desired form and density, frames being provided at the top and bottom and connected by bolts.

Combined Typewriter and Adding Machine.—Fred F. Main of Chicago, Ill., assignor to John T. Underwood of Brooklyn, in patent No. 1,110,448 provides a typewriting attachment for adding machines in which the printing platen is common to the printing mechanism of both the typewriter and the adding machine and the operating shaft of the adding machine may be manipulated to bring the platen into printing position relative to either set of apparatus.

Theatrical Illusion Apparatus.—Patent No. 1,110,665, to Timothy R. Barrett of Bordentown, N. J., is for an illusion apparatus in which a background and foreground are provided in connection with a treadmill and a movable representation of a vehicle or car which can be moved toward and from the treadmill so that a person on the treadmill can convey the impression to the audience that he is apparently in pursuit of the vehicle and can fall or otherwise produce amusing effects in simulating an effort to overhaul the car.

Some Bowling Ball Patents.—John W. Hyatt of Newark, N. J., has patented, No. 1,111,022, a bowling ball, seeking to furnish a substitute for solid ball of wood or the like, by constructing the ball with a hollow metallic body on which is cemented a layer of fibrous material which is covered with a relatively non-yielding homogeneous composition. The same inventor has secured a patent, No. 1,111,023, in which is shown a hollow bowling ball with a novel construction of disappearing finger hold or handle.

Issued Patents Geographically Classified.—It is interesting from time to time to notice the geographical distribution of the issued patents. A review of the patents issued on September 15th, 1914, shows that patents were issued on that day to residents of every State save three, Arizona, Nevada and Wyoming. New York leads the list with a round one hundred patents. New Jersey comes next with sixty-six. Illinois is a close third with sixty-five, and Ohio has fifty-seven. The District of Columbia had eight, a large number when the population relatively to that of the States is considered.

Lock-Entrance Caisson for the Panama Canal

ON the 16th of September last an enormous caisson was completed at San Francisco for the Panama Canal.

It is to be used as a barrier or dam, across the entrance to any one of the lock sites when repairs or painting are required to be made to the mitering lock gates. It can also be used for unwatering any one of the lock chambers to permit of making an inspection of the culvert stony gates or cylindrical valves installed within the lock walls.

It is the largest gate of its kind ever constructed having a length of 113 feet 10 inches, extreme depth, 66 feet; molded breadth, 36 feet; and displacement, 2,583 tons at light draft of 32 feet. The maximum draft when in service is 62 feet.

The sides of the caisson have curved surfaces throughout, with lines like those of a ship. Along its ends, which are vertical, as well as along the horizontal keel, there are heavy plate girders fitted with continuous timber cushions which serve, when the lock is pumped out, for transmitting the water pressure to smooth cast iron plates attached to the masonry.

Structurally, the caisson consists essentially of horizontal plate decks, girders, and stringers; transverse and longitudinal framing and bulkheads; plate breasthooks at the ends of the caisson; girders along the vertical ends and keel; and steel plating or sheathing that covers the skeleton. The design is such that the decks, girders, and breasthooks serve to transmit the greater part of the hydrostatic pressure to the side walls of the locks, the balance of the loading being carried to the horizontal sill by the vertical, transverse framing.

The caisson is equipped with a very large pumping system, consisting of four 20-inch discharge, vertical, centrifugal volute pumps, placed about 12 feet above the keel. Each pump has an average discharge of 13,000 gallons per minute when pumping out of the lock chambers. Each pump is driven by a 225 horsepower electric motor, located 37 feet above the keel. The deck is made absolutely watertight and serves as the top of the water ballast compartments. The piping system in connection with each pump is so arranged as to enable the operation of the suction discharge to take place from either side of the caisson. Two of the pumps have connections made in such a manner as to be used for emptying the water ballast compartments when it is desired to raise the caisson out of its seat, after it has served its purpose at the lock entrance. All the valves, motors, etc., are arranged to be manipulated from the caisson's operating deck.

Electric current is supplied to the motors from the main power cables installed within the locks. The motors, therefore, cannot be operated until the caisson is placed in one of the recesses provided for it in the lock chambers, or when at its mooring position in Gatun or Miraflores lakes.

It required 1,500 tons of structural steel to build the caisson and 800 tons of permanent ballast placed in its bottom to give it stability in its light draft condition.

Planets and the Weather

DO the planets affect the earth's weather? This well-worn question is discussed in a somewhat novel way by Prof. W. J. Humphreys, of the Weather Bureau, in the *Monthly Weather Review*. The writer frankly admits that the planets do affect the weather, though to a very slight extent, and he explains just how and how much. The weather ultimately depends upon the reception and emission of radiant energy by the atmosphere. This energy, of course, comes mainly from the sun; but the planets send us a little, and they also affect the amount received from the sun by changing the earth's distance from that luminary through the perturbations they produce in the earth's orbit. The energy received from the planets may be expressed in terms of their brightness, and this varies greatly. The light of all the planets, each at its maximum, is about equal to that of 260 stars of the first magnitude, while the light of the sun is roughly equal to that of 73,000,000,000 first magnitude stars. With their varying distances, the range in the aggregate brightness of the planets may amount to the light of 240 first magnitude stars, though it is rarely more than 230 such units. From these figures it may be calculated that variations in the planetary distances can produce a maximum change of about one two-millionth of a degree Fahrenheit in the temperature at the earth's surface. The change of the earth's distance from the sun, due to perturbations in its orbit caused by the planets, is a much more important factor in determining terrestrial temperatures, though it, also, is practically negligible. Jupiter changes the distance of the earth from the sun by about 1 part in 20,000; Venus and Mars, each by about 1 part in 90,000. The total change due to the combined section of all the planets is seldom greater than 1 part in 17,000. The maximum effect of this fluctuation under the most favorable circumstances is found to be about 0.02 deg. Fahr. in the earth's surface temperature.

"Ordinarily, though perhaps not always," says Prof. Humphreys, "this, too, as far as weather and climate are concerned, is a negligible temperature range," and the variations in question "have nothing in common with the astrological or other nonsense that seems usually to be in the minds of those who insist that the planets do greatly influence or even control our weather and our climates." As to the moon, Prof. Humphreys shows that its radiation alone may change the surface temperature of the earth by about 0.00025 deg. Fahr., while the moon's perturbative effect upon the earth's orbit may produce a maximum range in terrestrial temperatures about equal to the maximum attributable to the planets, viz., 0.02 degree. A more important possible effect of the moon upon the weather is, however, hinted at; the tidal action of the moon affects the flow of ocean currents, and these, in turn, may be concerned with small but measurable changes in the weather of certain localities.

Award of John Scott Medal for Ignition System

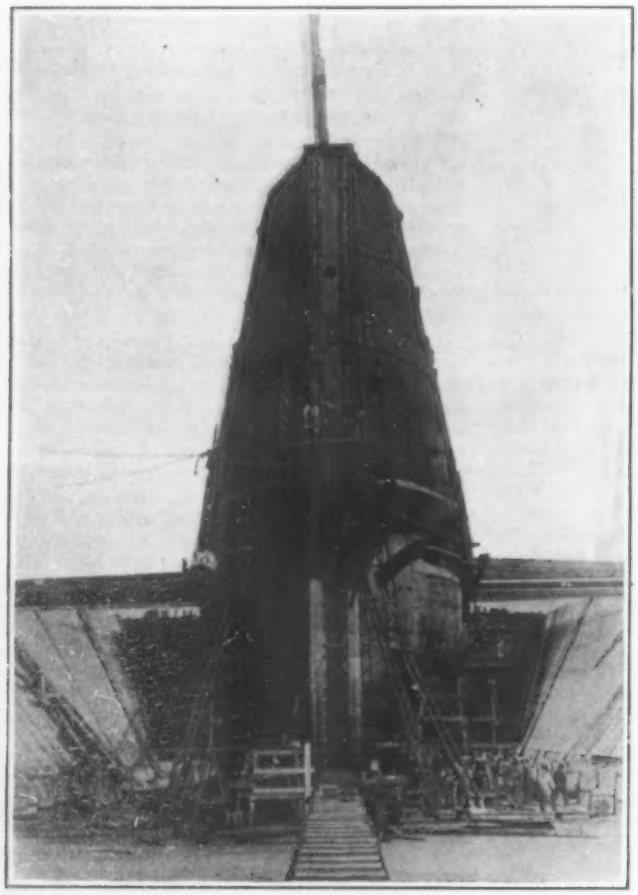
THE city of Philadelphia has awarded to Mr. Arthur Kent the John Scott legacy medal and premium of the Franklin Institute for the Atwater Kent unisparker and ignition system. The formal ceremony of conferring the medal will take place on November 18th at the regular meeting of the Franklin Institute.

This medal and premium was bequeathed by John Scott, chemist, of Edinburgh, made in the year 1816, creating an endowment to the city of Philadelphia, directing the interest and dividend to be distributed annually among "ingenious men who make useful inventions."

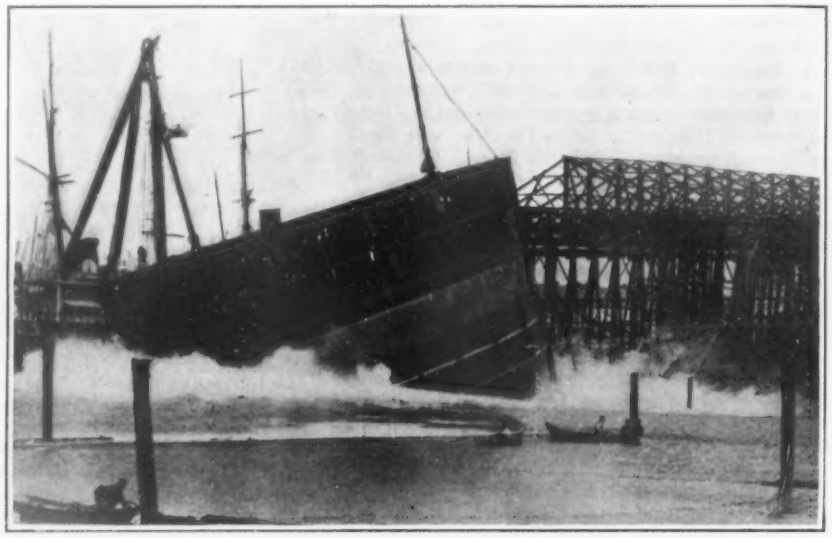
In 1834 the city of Philadelphia vested the award of this medal in the Franklin Institute of the State of Pennsylvania.

This is probably the first award of such a character that has been made in America to any manufacturer of automobile parts.

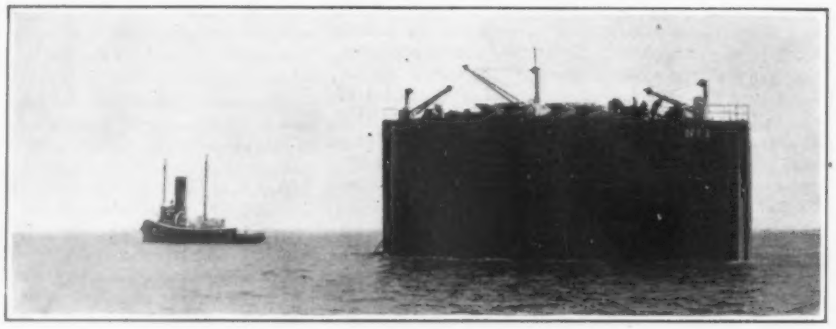
The device consists of a contact-breaker, governor, and distributor, arranged in one structure. The contact-breaker is in the primary of a non-trembler coil circuit, and is so designed as to be operative only when the engine runs in one direction, thus preventing backfiring. The governor automatically advances and retards the spark according to the requirements of the engine. The distributor is in the secondary circuit of the coil and distributes the sparks to the several cylinders. The current in the primary circuit can be reversed at will, changing the polarity of the contacts and preventing their disintegration.



Completing the work on the caisson in drydock.



Launch of the huge caisson for the Panama locks.



Start of the long journey down the coast to Panama.

LOCK-ENTRANCE CAISSON FOR THE PANAMA CANAL

Forest officer using shoulder-pack water-bag and fire shield in putting out a surface fire.

Fighting a forest fire with shoulder-pack and air-pressure horse-pack apparatus.

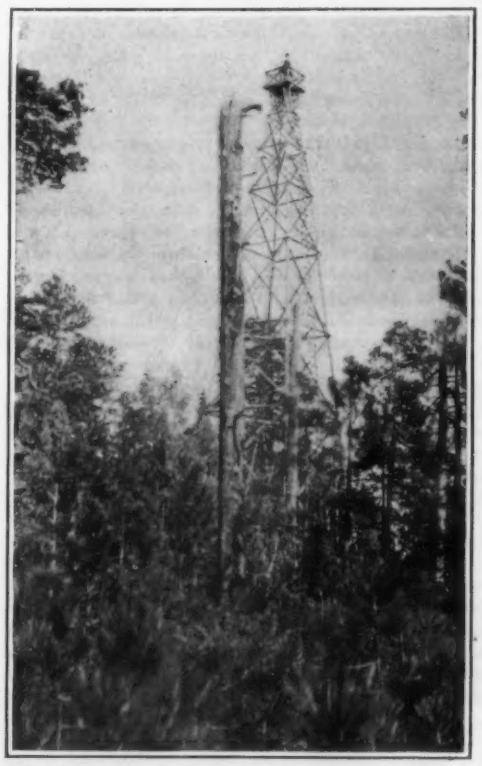
Forest Fire Fighting

Construction of a 115-Foot Watch-Tower With Limited Equipment

THE national forests of the United States, not counting the preserves in Porto Rico and Alaska, cover an area five times that of the State of New York. As may well be imagined the task of caring for these enormous stretches of timber land is no small one. The principal danger is fire, which annually exacts a levy of many thousand dollars' worth of timber. In order to reduce the loss to a minimum the Government has established novel fire departments in the timber lands. Of course the main object is to locate the fire quickly and bring the fire fighters to the spot before the blaze has assumed dangerous proportions. The difficulty of doing this in large wooded areas is at once apparent. The old watch tower system used in our cities before the electric fire alarm came into use has been adopted by the Government. Lookouts are posted at strategic points throughout the range, and their duty is to sweep the forest with their binoculars in order to detect the first curl of smoke rising above the tree-tops, which would indicate that a fire had started. Then by means of range finders, or triangulation with another tower, the exact spot is located and telephoned to the fire fighters of the particular district in which the fire has started. In an incredibly short time the forest fire department is on the spot with water-bag, chemical tank, rake, shovels, etc.—a variety of tools unknown to the city fire department. It is usually the brush that takes fire first, and when it is impossible to put out the blaze with the water bag, the fire is encircled with a bare strip of ground from which the leaves have been raked up, and the brush chopped down. Then a counter fire is started, burning in toward the original fire so that eventually the blaze burns itself out for lack of further fuel. The accompanying photographs illustrate some of the apparatus employed. The equipment has to be transported to the scene of the fire on the backs of horses and mules, and consequently it must be of very light construction. The "shoulder-packs" consist of water-bags that are carried on a man's back, and are fitted with a hoze and spray nozzle with which he can direct the stream where it will do the most good. As the pressure of the stream is very small, due to the low head of water in the bag, the fire fighter has to walk in close to the fire, and, hence, to protect himself from the intense heat, he has to use a shield, such as is shown in one of the photographs. In addition to this there are pressure tanks carried by horses with which a more efficient stream of water may be directed upon the fire. In some cases chemicals similar to those used in our chemical engines are used and are carried in a couple of copper cylinders on horseback.

The forester must be an all-around man and ready for all emergencies. An example of his resourcefulness is shown in the building of a watch tower 115 feet high, which is illustrated herewith. It was a remarkable piece of work under the circumstances, and a detailed description of the manner in which it was erected will be found very interesting. The tower is located in the Sitgreaves National Forest, Arizona. A triangulation station was needed in one of the districts, but because the area was covered with tall timber and had a very gentle slope, no good natural lookout post could be found at the west end. Several points were considered where the timber was only 35 to 40 feet high, and where a 40 to 50-foot tower would be sufficient; but as it proved, there was only one point from which a satisfactory view over the forest in all directions could be obtained, and here, unfortunately, the timber was so tall that the tower would have to be at least 100 feet high. The tools and rigging at hand were sufficient to build a tower of only half that height, but, nevertheless, it was decided to undertake the building of the tall tower at once, without waiting for further equipment, for the reason that the nearest base of supplies was 75 miles away, and the dangerous fire season was close at hand. The materials available consisted of 300 feet of ¾-inch rope in four pieces, the longest being 100 feet in length; two double blocks 6 inches long, and one single sheave block of the same size. The tools consisted of axes, two-men saws, hatchets, crowbars, two pairs of lineman's climbers and belts, and a brace and bit. Telephone wire was used for guys. The crew was made up of temporaries and two rangers under the direction of one of the forest rangers. At the start there were eight men, including one cook, one teamster, and the man in charge. By the time the tower was half built the crew was cut down to four men.

Forest service mule with his load of fire tool boxes.



Fire lookout 115 feet high, built by a crew of resourceful forest rangers at Promontory Butte, Sitgreaves National Forest, Arizona.

The first task was to cut and peel the timbers and skid them to the spot where the tower was to be erected. Much care was necessary in selecting the main poles, some of which were skidded out of dense thickets. Altogether, over one half mile of poles, linear measurement, was used.

The dimensions of the tower are as follows: Base, 30 feet square; platform, top, 6 feet square; height, 115 feet.

The main corner poles average 16 inches in diameter at the butts and 4 inches at the top. They are spliced at a height of 45 feet and at 100 feet. Each splice is bolted and then bound with bands of telephone wire. The timbers are fastened together with ½-inch lag screws.

In raising the poles a tree nearly 100 feet in height was used to hoist from, but since the top of this tree was not stout enough above a height of 75 to 80 feet to carry much weight, some difficulty was experienced in placing the 55-foot poles upon the top of the 45-footers. With an abundance of rigging, a derrick boom could have been rigged, but it must be remembered that there were only three pulley blocks, and they had to be used in hoisting each pole or brace. The men were so short of rope that when they raised the second length of the main poles, it was necessary to hoist until the blocks came together, lash the pole so that it could not fall, and then stretch the tackle for another pull.

None of the crew had had any previous experience in building towers, and they were by no means expert climbers at first, but they improved rapidly, so that before the tower was completed several of them were excellent men for high work.

The first poles were cut on May 21st, and the tower was completed and in use on June 20th. The time spent in cutting and peeling logs and constructing the tower amounted to less than twenty-four working days of eight hours each for a crew which averaged five in number.

The Periodicity of Sun Spots

THE sun-spot period, evaluated as being 11⅛ years, is only an approximate indication which does not account with precision for the facts of observation. In a series of notes to the monthly notices of the Royal Astronomical Society, Tuaner shows that other periods of 8⅛, 10¼, 14⅜ years must be considered, although the period of 11⅛ is much the most important for our present epoch, a fact which confirms the recent researches of Schuster and Michelson. But, unless one wishes to throw grave doubt on some of the earlier observations, it would appear that this period does not satisfactorily fit in with the sun-spot phenomenon as manifested during certain years. For instance, the period 10¼ years seems specially concordant with the phenomena observed from 1749 to 1830; after which the cycle of 14⅜ years appears to be most important.

In spite of the ingenious attempts which have been made it will be seen that the details of the mechanism of the solar activity remain very mysterious.

A Vaccine for Rabies

THE learned and well-known French naturalist, Mme. Phisalix, has for some time been conducting experiments with the venoms of various batrachians and serpents. She has just completed these, says *La Revue* (Paris) by a series of experiments, which have for their object the successful vaccination of animals against the much-dreaded disease of rabies. "This learned naturalist discovered some time ago," we read, "that the mucous secretion of batrachians has the property of immunizing against its own action, and also against that of the venom of the asp.

"Proceeding from this point Mme. Phisalix formed the idea of utiiizing the seminal fluids for immunization against the virus of rabies. She injected into rabbits mucus from the salamander, repeating the operation at several days' interval, and afterward inoculated them with about ten milligrammes of the venom of the asp viper, a dose twice as great as that which suffices to produce death.

"A week afterward they were trepanned and the fixed virus of rabies was injected into the meninges. The rabbits thus vaccinated by an association of the vaccine of the salamander and that of the asp manifested no symptoms of rabies; only one was attacked. The duration of the immunity, it is true, was not very long, and the effects of the remedy do not generally persist beyond six weeks.

"Mme. Phisalix also tried to determine whether one of the two venoms had a preponderant action. Hence she immunized some rabbits with the vaccine of the salamander and others with the vaccine of the asp viper. The results were not so conclusive as with the association of the two vaccines. . . . The continuation of these remarkable experiments is awaited with interest."

To this summary by Dr. Caze we may add the detailed report of certain observations made by Mme. Phisalix and presented to the French Academy in July by Edmond Perrier as follows:

"Most authorities admit that cold-blooded vertebræ are refractory to rabies. But this opinion has been verified for only a few species. Remlinger inoculated with the fixed virus of rabies fish, and the Mauretanian turtle without infecting them. . . . Since 1910 I have frequently and at different seasons inoculated with the fixed virus many species of batrachians and reptiles, employing in each series as many subjects as were necessary to vary the place of inoculation: subcutaneous conjunctive tissue, peritoneum, muscles, anterior chamber of the eye.

"Experiments on *Rana temporaria* and *esculenta*, *Bufo bufo*, *Salamandra maculosa*, among the batrachians; on *Angius fragilis*, *Tropidonotus natrix* and *Viperinus*, *Vipera aspis*, among the lizards and serpents. In ten series of these animals three were kept at 35 deg. Cent. by stove heat. . . . without the results furnished by the other groups being modified. These results were entirely negative as regards most of the preceding species; but salamanders and vipers constantly died after inoculation with the fixed virus, the first in 5 to 12 days, the second in 5 to 8 days with symptoms of paralysis like animals suffering from rabies. These experiments were performed on 48 vipers and 22 salamanders. The place of inoculation made no difference in the length of survival; thus the vipers died no quicker when the virus was in the eye than when the inoculation was made under the skin.

"These vipers, which were possibly infected with rabies, were, however, paralyzed only in the muscles of the body, for they could bite by erecting their venomous pangs if strongly excited; but it was impossible to them to assume the attitude of defense and to extend themselves suddenly, as they ordinarily do. Left to themselves they remain immobile until death.

"The autopsy on salamanders and vipers dead after inoculation with the fixed virus revealed only very slight congestive lesions, without a determined fixity. The encephalon emulsified and used to inoculate healthy subjects, made them die, at first in the same time as the fixed virus, then the duration of survival diminished by degrees, and in both cases was not more than 2 days after the fifth passage.

"Did the vipers and salmanders die of rabies? The test inoculation under the meringes of the rabbit, which gives absolute certitude, as proved by Pasteur and Roux in 1881 was performed. The rabbits were trepanned and inoculated with the suspected emulsion of the brain of the viper and of the salamander. None of them took rabies, and moreover none of them was immunized against the fixed virus, used for inoculation one month and months afterward. *Hence the vipers and salamanders did not die of rabies.*

"Were they, then, sensitive to inoculation with nonrabic cerebral substance? Yes; this was fully confirmed by experiment. *The normal nervous matter of rabbits or that of their own species, is a poison for the viper and the salamander, while it has no injurious actions on other animals even when inoculated.*

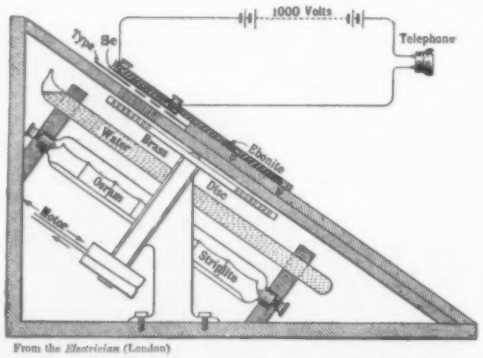
"These experiments prove that the toad, slow-worm, adder, are, like the frog, fish, and Mauretanian turtle, refractory to experimental rabies communicated by inoculation with the fixed virus, and that the exceptions presented by the terrestrial salamander and the asp viper are because these are poisoned by their nervous substance and by that of the rabbit, whether the latter be healthy or rabic."

Hearing Print

By the English Correspondent of the Scientific American

SOME time ago the SCIENTIFIC AMERICAN published an account of Dr. Fournier d'Albe's instrument for rendering differences of lighting audible. Since then the apparatus has been greatly improved and it is now possible for the blind to read by the sense of hearing, just as with the Braille type they read by the sense of touch. The apparatus by which this is accomplished is essentially an ingenious application of the fact that the substance called selenium has the peculiar property of changing its electrical resistance with changes in the intensity of the light illuminating it. If therefore this substance forms part of an apparatus (such as a Wheatstone bridge) which is so constructed that fluctuations of resistance produce electric currents, we can, by passing these currents through a telephone receiver, cause variations in intensity of illumination to produce sounds. This is the root principle of Dr. Fournier d'Albe's optophone. In the latest form of the apparatus the light used to illuminate the selenium is intermittent in character. Selenium is capable of following fluctuations in intensity of light with extreme rapidity, although in converting light oscillations into telephone sounds the higher notes would be feebler than the lower ones were it not that this tendency is largely counterbalanced by the resonance of the ear and of the telephone membrane. It is found in practice that maximum audibility occurs somewhere about a frequency of 1,000 waves per second.

The optophone used for reading purposes is illuminated by a line of light broken up into dots, the light



From the *Electrician* (London)

Diagram showing general arrangement of Dr. Fournier d'Albe's reading optophone.

of each dot being intermittent and with a frequency different to that of the others. Thus, in one apparatus actually constructed the frequencies of the eight dots composing a line eight centimeters long are in the ratio of the numbers of the diatonic scale, the eight dots forming an octave with its intermediate intervals. The actual frequencies are 24, 27, 30, 32, 36, 40, 45, 48.

By passing opaque bodies between the light and the selenium so that the dots of light are interrupted, changes of sound in the telephone are produced. Dr. Fournier d'Albe accordingly had large type printed on gelatine or other transparent material and passed between the light and the selenium. He found that the resultant sounds varied, as would be expected, with the shape of the obstruction, in this case a printed letter of the alphabet, and with a little practice the letters of the alphabet could be recognized by the ear.

The diagram shows the general arrangement of the apparatus. The line of light is furnished by an Osram "striplite" of 100 candle-power, which is concentrated by means of a cylindrical water lens upon a revolving perforated brass disk provided with eight circles with the number of holes requisite to give the eight various frequencies. The disk is spun at about 20 or 30 revolutions per second by means of an electric motor. The line of dots of eight different frequencies exists, therefore, just at the surface of the brass disk. As it is not feasible to bring the transparency to be "read" into contact with the brass disk, the luminous dots are transferred to the upper side of a wooden partition by means of a set of glass rods with flat ends embedded in the wood opposite the luminous dots. The flat ends of the rods are flush with the surface of the board, and the transparency can be safely and conveniently slid across them. The selenium bridge *Se* is mounted above the transparency with just sufficient clearance to allow for free displacement. The luminous dots transmitted by the type or other transparency impress their frequencies upon the selenium, and the latter gives a musical note corresponding to each dot, even when the beams of light overlap on to the same portion of the selenium. When that occurs with neighboring notes, "beats" are heard, just as they are when neighboring notes on the piano are struck together.

The selenium bridges used have a resistance of several megohms and require about 1,000 volts for the best results. The telephones used were a pair of 4,000 ohms each. Since type of any size whatever can be put into the shape of a white-on-black transparency by means of photography, and simultaneously reduced to the proper size, the reading of type by the blind is now reduced to a matter of photography. The smallest type successfully read so far is an inch high, photographed white as a transparency. But it is quite unmistakable. The two vertical strokes of *H* or *M* give a chaos of notes, the middle stroke of *E* gives a chord, and the curved lines of *O* and *S* give characteristic flourishes of sound. Dr. Fournier d'Albe states that the alphabet of capital letters can be learnt in about an hour, and once the sounds are learnt, the process of reading may become as rapid as that of reading by sight.

As an interesting development it has been found possible to design transparencies which will give any required musical note, and a number of musical compositions have been transcribed in this manner. The notes so produced are particularly clear and free from overtones and a "musical optophone" fitted with a keyboard has been constructed.

But it is obvious that the chief desideratum is that ordinary black-on-white type, printed on paper, should be read optophonically. Experiments which have been made in this direction are very encouraging. A strip of slate long enough to cover the line of dots was cut and perforated with holes so as to let the upper ends of the glass rods project just beyond its surface. The slate was covered with selenium and sensitized. A glass plate was laid over the wooden "reading desk" and the glass rods, and a printed advertisement of large type was placed face downward on the glass. The white paper produced a chaos of all the notes, which broke up into more or less well defined notes as the black letters were passed over the rods. But the loudness and distinctness so obtainable were greatly inferior to what they are by transmitted light. Still, the solution is there in principle, and it is only a matter of making the type smaller and the effects louder and more distinct. The blind will then be able to read everything as well as the sighted.

The Current Supplement

THE current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2028, for November 14th, contains the second and concluding instalment of a most interesting article telling how to collect and preserve insects that will be greatly appreciated by every amateur who indulges in this pursuit, as it gives, and illustrates, the best methods followed by scientific collectors. The measurement of radioactivity constitutes a sensitive method of chemical analysis for substances containing quantities too small to be detected by the spectroscope, and the description of the construction and operation of an instrument by which direct measurements can be taken will interest both the physicist and the electrician alike, as it can be also employed as a delicate electrometer. An article on radium therapy reviews the results of the use of radium for the treatment of a great number of diseases at the London Radium Institute, and gives a definite basis for judging the powers of this new and wonderful agent. The causes of erosive effects on canal bottoms by power vessels is discussed in a concise article, which is profusely illustrated by photographs of the actual tank experiments. A timely article is that which deals with the engines used by France and Germany in their submarines. Another summarizes the preventive measures taken in different countries to protect their armies against typhoid, which is now prevalent at the seat of the war. An experiment in organic education tells about a rational attempt to fit the course of study to the child, instead of trying to fit every child to the same fixed course. In the article on the design of floats for hydro-aeroplanes the technical scientist will find an exhaustive article on this complex subject. Street sprinkling by trolley cars as it is done abroad, is described in another note, and there are articles describing a direct reading psychrometer and regulating storage batteries from a distance.

New Economic Type of Electric Power Distribution for Small Consumers

A RATHER original proposal, calculated to bring the use of electricity still more within the reach of the small consumer than is the case at the present day, is due to a German engineer, K. Schmidt, according to *Prometheus*. The new system proposes to make use of a small transformer by means of which the current is stepped down to about 50 volts. It is then feasible to use inexpensive bare wire conductors and low voltage lamps of 10 to 25 candle-power, which can be made and used very economically.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Substances for Paint

To the Editor of the SCIENTIFIC AMERICAN:

On page 242 of your issue dated September 26th, 1914, is an article entitled "Substances for Paint," wherein is made the following statement:

"Owing to the extensive use of graphite for many purposes, the natural product no longer suffices, but fortunately the new electric furnace processes come in to make up the deficiency."

We beg to say that the author has rather inadvertently made a misstatement, as the graphite which we mine in Mexico from an inexhaustible deposit is very largely used in the manufacture of paint not only by ourselves but a great many paint manufacturers who purchase it from us, and this Mexican graphite is amorphous in character and very pure, analyzing 85 to 90 per cent graphitic carbon.

THE UNITED STATES GRAPHITE COMPANY.
H. C. WOODRUFF, General Manager.

Saginaw, Mich.

Germany's Big Siege Guns

To the Editor of the SCIENTIFIC AMERICAN:

Having just returned from Germany on board the steamship "Rotterdam," after having left New York on September 1st on board the steamship "Noordam," I notice in your valuable paper, under date of the 17th ultimo, a statement to the effect that the continued rumors about Germany's using siege guns of 42 centimeter have no foundation, and that the largest siege guns used by Germany have 28-centimeter caliber.

I beg to correct your statement. The German "siege artillery" is using siege guns of 21, 28, 32, and 42-centimeter caliber. The 42-centimeter gun throws a shell one meter in length and of 1,705 pounds weight. The carrying distance is well over 15 miles. Two of those 42-centimeter guns were stationed at the village Lierre, about 10 miles from the forts of the inner line of fortifications of Antwerp. I could hear their firing at a distance of over 45 miles at the Dutch port of Vlissingen (Flushing). These guns have to be transported by rail and are not mounted upon caterpillar wheels like the 28-centimeter mortar of the German army, nor are they transported in two parts like the 32-centimeter Austrian mortars. The rails for their transportation are specially laid to a base of re-enforced concrete, upon which the gun carriage rests during the firing.

The 42-centimeter gun is attended to by engineers of the Fried. Krupp'sche Gussstahl Fabrik, Essen, who have been appointed officers by special command. The firing is done electrically at a distance of over 100 meters, and nobody is allowed within a radius of 100 meters until after the discharge of the gun.

The designers responsible for these 42-centimeter guns have received the Iron Cross.

There are only 7 or 8 of these guns in operation. At the time of my visit at Essen, the last week of September, 1914, several more were building, as also a small number of 52-centimeter guns, built especially for firing across the English Channel. JOSEPH SCHAEFFERS.

Cleveland, Ohio.

[If Krupps are building any 52-centimeter guns, they are not intended for firing across the English Channel; for the distance (over 20 miles) would prevent any observation and correction of the fall of the shots. They would be used to keep the British fleet at a great distance from any ports which Germany may be able to capture and convert into submarine bases on the Belgian and French coasts.—EDITOR.]

Protective Coloring for Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

The extensive use made of aeroplanes for reconnaissance in the present war recalls to mind some investigations which I made last spring (with the practical assistance of a small boy in the neighborhood) on the visibility of light blue colored kites in the air.

My rough experiments seemed to indicate that an aeroplane colored a trifle darker blue than that of the sky would be practically invisible at a comparatively low altitude, even against a background of white or gray clouds, especially if it were moving rapidly. Even if it were not entirely invisible, the general outlines would appear so indistinct as to render the accurate determination of the range almost impossible. Of course, the entire machine, including the metal parts and also the clothing of the aviator, would have to be azure blue, and all parts which observation would show to be usually in shadow should be of a lighter shade, in order that the whole present a uniform sky-blue color at a distance. To be most effective, the engine should be muffled by a silencer of the Maxim type. The same scheme might be feasible with dirigibles, although it would be much more difficult to produce the illusion of a uniform blue color in so large an object.

I do not know whether any investigation along this line has been attempted before, but if it has not, I believe it is worth the attention of those interested in military aviation. CHARLES PHILLIPS.

Minneapolis, Minn.

The Force It Takes to Stop an Automobile

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of September 19th, Mr. Joseph Livermore arrives at an approximate formula for the least distance in which a motorcar can be stopped by brakes on the hind wheels. As he says, he has not taken into account all the factors that determine this distance, as there is no need for great theoretical exactness. However, I think there is one point of interest not commonly understood when a car is accelerated, in either sense, by the hind wheels. I refer to the shift of pressure from the rear to the front wheels in braking and the converse when driving. The amount is easily calculated.

Let h = height of the center of gravity above the road,
b = the wheel base,
m = the weight of the car,
M = the weight on the hind wheels when the car is at rest,
f = the coefficient of friction between the tires and the road,
a = the acceleration of the car in feet per second.

When there is an acceleration a there is caused a couple of amount $\frac{m}{g} h a$ which tries to turn the machine in one sense. Since the machine does not turn a somerset, there must be an equal couple in the opposite sense acting, which we can express as (loss of weight on wheels) times (wheel base). Thus the loss of weight =

$$\frac{m}{g}\frac{h}{b}a$$

Since the total weight of the car on the road is the same, the other set of wheels must gain a like amount,

$$\frac{m}{g}\frac{h}{b}a$$

Using the diminished pressure on the hind wheels to calculate the force of braking at our command, we find

$$a\,m = f\left[M - \frac{m}{g}\frac{h}{b}a\right] \text{ and hence } a = f\frac{M}{m}\left[\frac{1}{1+\frac{f\,h}{g\,b}}\right]$$

This shifting of weight is, of course, of no great importance in ordinary practice, but when a great deal of power is being used, should it not be reckoned with? For instance, when the front wheels of Mariott's Stanley jumped off the ground and wrecked him so badly, it might well have been due to the loss of weight on them caused by the great torque of his engine at 130 or so miles per hour. Again, is not this shift of weight to the front wheels in braking an argument for front wheel brakes (which I understand some foreign cars have already adopted), if only to lessen the "chattering"?

W. VAN B. ROBERTS.

A Public Phonographic Library

To the Editor of the SCIENTIFIC AMERICAN:

I have been reading a thousand and first article illustrating Mr. Edison's patience in putting new devices on a practical basis; in this instance an account in your journal of a phonographic check for the use of typists.

I am innocently ignorant of all mechanical technicalities and am perhaps too anticipatory; but it *does* appear that my long dream of enjoying a public phonographic library should begin to materialize. It involves simply a first reading of books *into* a standard recorder, the uniform records then to be shelved in lieu of books, or along with them in the library or "phonorium," as I shall name it at a hazard, to be taken down at liberty and inserted in the reproducing devices, arranged centrally along the tables, and provided with antiseptic ear-pieces. Or the records could be heard by groups of persons by means of machines provided with megaphones in small side rooms, or be lent for use, at the homes of the subscribers.

I understand there is a method whereby a wire or band of indefinite length has been made to reproduce words; but should this not be practical, I see no reason why a series of very thin disks could not be inserted, in order, with but little more trouble than the turning of pages, the order of the disks being maintained by folding them back over a loose ring or cord at one side, in the manner of a book. Possibly such a portfolio could be even rolled upon itself to a degree and carried about quite as conveniently as a book. Such records might be made by any clear reader, and the saving of both time and eyesight to the hearers would be considerable, the process of *hearing* words being indeed infinitely more natural than *seeing* them. It would be a peculiar boon to the blind, and in a less degree to slow readers, like myself, who find it possible and very enjoyable to listen to a book being read, perhaps twice as rapidly as they could read it themselves.

We can only dimly fancy the thrill of hearing Shakespeare read one of his sonnets; but with our writers their reading for the future depends only upon a *literary* development of a phonograph that already obtains largely as related to music. Indeed, it would be more plausible to develop a *talking machine* before a *singing* one, as the latter demands primarily a perfection of tone, a matter in which success is still remote, while in the former this is a somewhat secondary matter; yet who would not consider the sense of the author's personality in the reader's favorite novel almost doubled if he were permitted to hear, say, the author himself quietly reading the book?

There is already on the market a phono-post card, doubtless a toy, but which suggests a possibility of correspondence by means of disks or reels, compared with which the refinements of the present devices as described by Mr. Wade would seem to be tediously slow and cumbersome.

My purpose in addressing the SCIENTIFIC AMERICAN is the hope that it may stimulate the interest of some inventive mind in a department of phonography that has, I believe, been neglected. C. P. CRUMB.

Philadelphia, Pa.

Ocean Fog Signals

To the Editor of the SCIENTIFIC AMERICAN:

Permit me to add to the observations concerning ocean fog signals contained in my letter printed in the SCIENTIFIC AMERICAN for July 4th, 1914. There are many ships which are not equipped with wireless apparatus. These could not make use of a system of signals such as I outlined. I believe a system of sound signals alone, for such ships, is practicable. At present the whistles are blown or the fog horns are sounded at more or less regular intervals, but neither whistle or fog horn is so arranged as to convey any definite information as to distance, or direction of movement of ships. A mechanical contrivance could be perfected that would, by the pressure of an electric button, sound the whistle or the fog horn, and also record the exact time. The time-recording apparatus could include a traveling ribbon similar to the stock ticker. This ribbon could be set to travel, say, one inch per second. This would show 1,100 feet of distance for each inch of traveling ribbon.

Now suppose two ships equipped with these devices. One ship sounds its whistle or fog horn. Instantly upon receipt of this sound wave, the button on the other ship is pushed. When the first ship receives the return sound wave, one half the distance traveled by the ribbon will indicate the distance between the ships. Here is the formula. A ship sounds whistle or fog horn, at the same time making a dot or dash upon the traveling ribbon. The ribbon travels twenty inches before the sound returns. That means that the ships are 10 times 1,100 feet apart, or about two miles. If the ships are approaching each other, after a little the ribbon will record, say, sixteen inches. That means that the ships are 8 times 1,100 feet apart. As the ships move away from each other the ribbon will run farther during the round trip of sound. After three or four round trips of sound a general idea of the speed and direction of each ship would be conveyed. The record of each ship would be the same, as a dot or dash would be recorded upon the ribbon simultaneously with the answering blast. The records would soon show about how far away the companion ship is, whether it is approaching or receding, and at about what speed.

Two incidental matters suggest themselves. In case of ships where there is no equipment of traveling ribbon, a good stop watch, accurately manipulated, would be a fairly accurate substitute. Where a wind is blowing hard enough to interfere with sound travel, the fact that the distance is averaged upon a round trip basis would seem to equalize, somewhat, this problem. If the wind retards in one direction it will accelerate in the other direction. I am well aware that there are other difficulties in the way of the successful use of sound to locate the position of ships in a fog. But there are difficulties in the way of every real improvement. Some time the fog problem will be overcome. I believe it will be overcome through some system of sound signals and automatic time records. Therefore, I offer my suggestions with the hope that there may be some hint in them that may help those who are working along this line.

Syracuse, N. Y. J. B. WEST.

Utilizing Vacuum Suction in a Carbureter.—In a patent, No. 1,108,181, to Edmund J. Kane, of Chicago, assignor to International Harvester Corporation, is provided a carbureter having an air passage way with associated fuel and water inlets and in which is localized a vacuum caused by the suction of an engine around such inlets in accordance with working conditions to make the operations of the engine economical under all conditions.

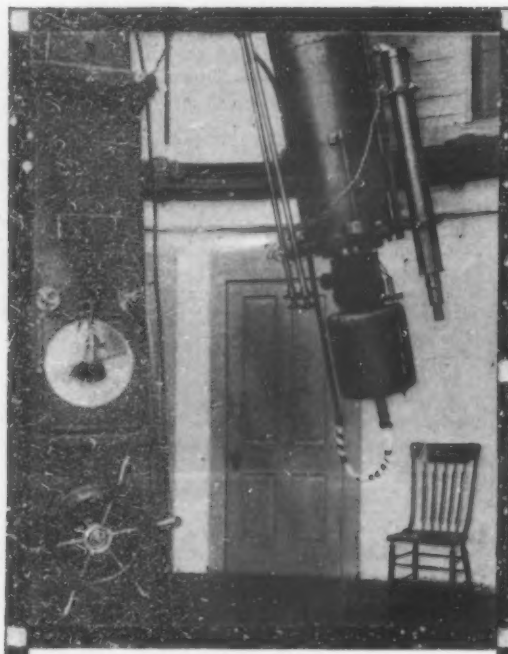


FIG. 1.—SELENIUM PHOTOMETER IN AN ICE PACK ATTACHED TO TELESCOPE. THE CONNECTING WIRES LEAD TO THE GALVANOMETER SHOWN IN FIG. 4.

FIG. 2.—SELENIUM CELL.

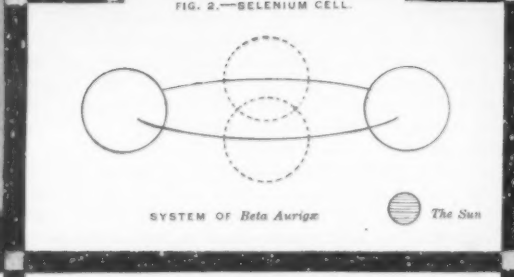


FIG. 3.—SYSTEM OF BETA AURIGAE AS VIEWED FROM THE EARTH. DOTTED CIRCLES SHOW ECLIPSE POSITION.

FIG. 4.—GALVANOMETER AND ACCESSORIES FOR SELENIUM PHOTOMETER.

The Electrical Measurement of Star Light

How Modern Technical Advances are Utilized in Astronomy

By Joel Stebbins, Professor of Astronomy in the University of Illinois

ALTHOUGH astronomers have studied the stars since the time of the Chaldeans, it is less than a century since any exact measures have been made of the amount of light which comes to us from even the more conspicuous heavenly bodies. There would seem to be very little scientific importance in the measurement of the candle-power of one of the little points of light in the sky, and there is not much of special interest unless that star happens to fluctuate in light. If we should find that the stars, as a rule, are all growing fainter and dying out, it would be a natural conclusion that our sun, which is only one of millions of stars, is likewise diminishing in splendor, and the future of the earth is of course wrapped up in the maintenance of the sun's light and heat. As a matter of fact, it is found that many of the stars do change in light periodically, some according to definite laws, and others quite irregularly and in a fashion which cannot be predicted. There is a certain class of these objects which, in the course of something like a year, vary one thousandfold, or even more.

The most natural instrument for the measurement of the light of stars is, of course, the human eye, which with all its drawbacks and peculiarities remains unapproached as an instrument of general adaptability. To illustrate the enormous range of usefulness of the eye, let us consider that if another sun were placed near our own, we could look at the two bodies, with difficulty to be sure, and estimate roughly which would be the brighter. Likewise we can compare the light given by two of the faintest stars visible on a dark night without an instrument. The ratio of the sun's light to that of one of these stars is ten million million, and the eye can be used for objects of all intermediate grades of brightness. It is as though we should compare two sounds at a distance of ten feet, and then move them to 6,000 miles and compare again, or as if we could use a balance for weighing a grain of sand and also a large ocean liner. Surely, for general purposes the eye is unsurpassed, but for accuracy the unaided eye does not come up to the standard of many instruments. In the estimates of intensity of lights as faint as the stars, visual observations are often in error 10 per cent, 20 per cent, or even more; and no photometer or instrument has been devised which will reduce the errors introduced by the eye to 1 per cent.

Photographic Measurements of Star Light.

Another method of measuring the light of stars is to take a photograph of a region of the sky and then measure the star images on the resulting negative. In this case there is the additional advantage of the permanent record of the plate, which is quite independent of the condition of the observer and the time of exposure, a point by no means to be ignored on a cold winter's night. Since the introduction of the dry plate there has grown up a whole field of photographic photometry of stars, and many of the most striking results are obtained by this method. Nevertheless, the photographs have errors of their own, due principally to the non-uniformity of the sensitive film, and astronomers have been looking for some other means of increasing the accuracy of the results.

In these days of mechanical and electrical wonders, even an astronomer may be behind the times if he looks through a telescope instead of letting a machine do the work, and such a problem as measuring the light of stars may call in the aid of electricity for its solution. At present there are two or three methods being developed whereby the light of a star is converted into an electrical effect, and in this way a measure is made. The first method which has led to results depends upon the peculiar properties of the element selenium. This substance is much like sulphur in its chemical action, and like sulphur, exists in several allotropic forms. It has been known for many years that the crystalline form of selenium changes its electrical resistance when exposed to light, and various attempts have been made to utilize this property as a principle in some photometer. The idea is attractive and very simple. Let a 16 candle-power lamp be placed at a given distance from a selenium instrument. Exposure to this light will change the resistance of the selenium, which may be measured with a galvanometer. Let the apparatus be arranged so that the scale reading is 16 for such a lamp, 10 for a 10 candle-power lamp, and readings for other lights in proportion. Imagine the change in the lighting industry if a householder could test the candle-power of his lamps with the same ease and certainty that volts and amperes are now determined! However, the combined efforts of many experimenters have not produced such an instrument, principally because of the idiosyncrasies of selenium. In the first place, this element is usually sensitive only to red light, and the results are not directly comparable with those of the eye, as the latter is affected by all of the colors which make up white light, the maximum visual effect being in the yellow. But worst of all, light-sensitive selenium is peculiarly unstable and erratic in its behavior, and no experimenter has ever solved to his own satisfaction the mysteries of this substance.

In Fig. 2 is shown a selenium cell of the usual form, made by Giltay of Delft, Holland, whose product is far superior to that of any other maker at the present time. Two wires are wound in a double spiral about a flat insulator, and the spaces on one face are filled with selenium which is afterward sensitized. The expression "selenium cell" is a misnomer, as the arrangement is simply a resistance or "bridge," the selenium elements being connected in parallel and the two wires are brought out at the back of the case. The exact method as used by Giltay for treating the selenium is a trade secret, but one way is to heat the cell to about 217 deg. Cent. (423 deg. Fahr.), when the selenium melts, and then let the crystals form during slow cooling. As a matter of fact, the best procedure is a secret to everyone who has ever tried it, as a half dozen cells, all made together in exactly the same way and annealed side by side in the oven, will show great variations in quality, usually most of them bad. A good cell of this character has a surprisingly high resistance, about 1,000,000 ohms in the dark, but exposure to strong daylight will reduce this to 20,000 ohms, about fifty times smaller. After such a decrease, however, the cell will require a whole day in the dark to recover its original condition and sensibility.

Using the Selenium Cell.

In the application of the selenium method to the stars, since we are concerned chiefly with variations of light intensity, it is immaterial whether the instrument is sensitive to the red or not; the main thing is to get rid of the irregularities of the selenium. Here it has been found that the temperature should be low as well as uniform, and, strange as it may seem, the power of a telescope is greatly increased if the selenium is surrounded with an ice-pack. It is literally true that this arrangement increases the effective sensibility of the apparatus one hundred-fold over what it would be in the summer months if the ice were not used. Fig. 1 shows such an ice-pack at the end of the telescope of 12 inches aperture at the University of Illinois Observatory. Wires lead in conduit from the photometer on the moving end of the telescope to a galvanometer on a solid pier in an adjacent room, Fig. 4. Two obesrvers are of course necessary, one to point the telescope and expose the selenium to a star at the focus of the large lens, and the other to read the galvanometer and record the measures. On fairly bright stars, the selenium photometer gives results accurate to something less than 1 per cent, but not yet to the tenth of a per cent which astronomers would like to have.

It would lead us too far afield to describe in detail some of the recent results in other lines of astronomy, but there is one product of spectrum analysis which is of special interest here. Peculiar changes in the spectrum lines of various stars can be explained only by the proximity of large planets or companion stars comparable in size with the main bodies. In fact, four out of five of all the stars thus far tested with the spectroscope show this peculiarity, and it may ultimately be found that the star which exists by itself is the exception. Our sun has a family of relatively small planets, the nearest, Mercury, requiring eighty-eight days to revolve in its orbit; but among this new class of double stars are found many systems where the two

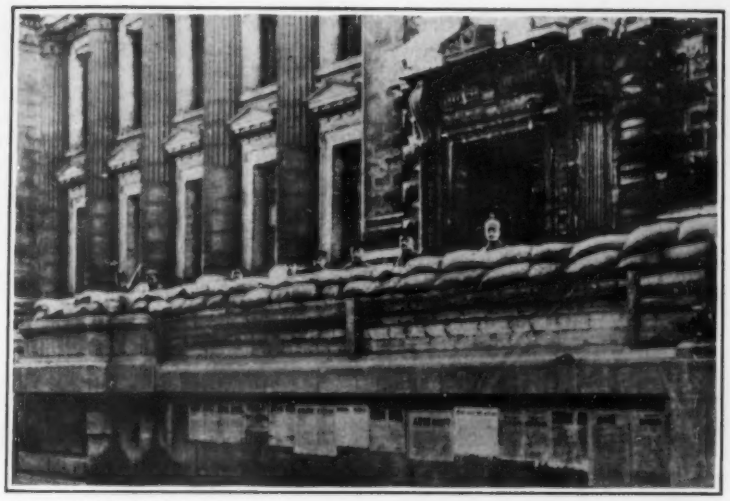
(Concluded on page 415.)

Copyright by Underwood & Underwood

A view of Fort Ertbrandt, part of the Antwerp defenses, blown up by the Belgians before they left.

Copyright by Underwood & Underwood

Fort Starbrouck after its destruction by the Belgians to prevent its falling into German hands when Antwerp was taken.



Copyright by Underwood & Underwood

The façade of the Royal Courts of Justice in Brussels, showing the German sandbag defenses prepared for an emergency.

Photograph by Underwood & Underwood

A public square in Malines after the second German bombardment. The terrible effect of modern shell fire is only too apparent.

Photograph by Paul Thompson

An English armored motor car conveying an aeroplane.

Photograph by Paul Thompson

One of the rotary cupolas of Maubeuge. The shell of a German siege gun evidently blew off the roof after penetrating the wall armor.

Copyright by Underwood & Underwood

A company of Turkish infantry. These men have been trained chiefly by German officers.

PICTURES FROM THE FRONT

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, November 7th, 1914

The French Campaign.

THROUGHOUT the week the Allies have maintained their general policy of a defensive campaign. They are evidently waiting for a further development of their military strength before they adopt the aggressive tactics that alone can give them victories. Their defense is, however, an active one, in that they deliver counter blows whenever an opportunity offers.

This war is undoubtedly going to last for many months. The Allies have no idea of giving in to the German demands, while the latter are unlikely to make concessions when the fighting is in their favor. If the contest becomes one of endurance the present tactics of the Allies in the west should prove very much to their advantage. The German assaults are enormously expensive in lives, and involve losses probably twice as great as those of the defenders. When the attacks are successful, the assailants compensate for their killed and wounded by subjecting the fleeing troops to much larger losses, increased by the stragglers and the captives. The Germans in the recent fighting have suffered the disadvantage of the attack without the compensating advantage of the pursuit.

The Allies have made local aggressive moves, however, in three districts. In the north they have endeavored to handicap the German campaign against Dunkirk by pushing forward a salient beyond Ypres that threatens to take in flank any advance either to its north or to its south. As long as the Allies can maintain this position they can prevent any serious progress of the Germans toward their objective on the coast.

In the Woevre district, southeast of Verdun, the French have been making strenuous effort to dislodge the Germans from their position on the Meuse River at St. Mihiel. Their army from Verdun has pushed eastward fifteen miles from the river, while an army from Toul has attempted to advance northward so as to cut in behind the German salient. The Germans have been able so far to hold back both forces sufficiently to maintain their possession of this breach in the Meuse fortified line and of the bridge over the river.

In Alsace the French have also made an advance and have recaptured Altkirch. This city in the number of times that it has changed hands during the war bids fair to rival the record in the civil war of Winchester in the Shenandoah Valley of Virginia, which in the advance and retreat of the various campaigns was captured or recaptured more than ten times. This Alsatian move of the Allies seems so far due rather to a weakening of the German defensive force rather than to any determined effort of the French to make a strategic move by way of the Rhine against the German flank.

The Germans are now confronted with the need of making some serious inroad upon their opponents' armies, while they still hold the advantage due to their better preparation for the war. Both in the east and in the west the Allies have attained such strength in the field that the Germans can no longer hope to be superior in both theaters of operation. They must sacrifice one campaign in order to secure hopes of success in the other.

At present they seem to have weakened their campaign in Russia, while they have not yet developed on the western front the blow that they must deliver if they hope to break through the line of the Allies. Vigorous attacks have been made at various points, but no advance has yet been pushed in the strength that would indicate an aggressive move involving all of the German forces in the west.

The campaign to push forward the German line along the North Sea coast has been carried on as a more or less local fight, extending over the 60-mile front from Arras to the sea. The German attacks between Dixmude and the sea were hard pressed and secured for them a foothold on the west bank of the Yser River at the beginning of the week. About 15,000 men crossed and captured the Belgian trenches along the river bank. The advance, however, led them into a Belgian trap, for the water in the lower stretches of the river is higher than the surrounding country, and is held back only by dikes or levees along the banks. When the Germans had pushed forward into the low grounds the Belgians cut the dikes and isolated those troops that were not overwhelmed by the flood. The German efforts to reach Dunkirk by this route have then ended in disaster.

Vigorous attacks were also made along all of the line from Dixmude to Arras, but the censored reports do not show in what strength. Most of them were certainly demonstrations made to deceive the adversary. Opposite Ypres and La Bassée, however, there seem to have been determined efforts by the Germans to break through after the failure of their campaign north of Dixmude.

Throughout all of the rest of their line in France the Germans have been content merely to bombard the enemy's line and to make sufficient minor attacks or reconnaissances in force to feel out the hostile positions and to insure the retention of full strength in the opposing troops.

The Russian Campaign.

The fighting in Russia has now developed to an extent that makes it rival in interest that in France. The opposing armies are now lined up on a continuous front extending from the Carpathian Mountains for 300 miles to the Vistula River, near Wloclawek in Poland. Along the East Prussian border there is another battle that is separated by 120 miles from the fighting west of Warsaw, but which must, nevertheless, be considered part of the general battle on account of its immediate influence upon the rest of the campaign.

The German aggressive campaign ended with the check at the Vistula River. Since then the Russians have been forcing the fighting. Their strategy is excellent and worthy of more than a passing glance.

When the German invasion from Silesia first developed in force, the Russians had an equal force along the Vistula with which to stop them. They took no chances, however, and called in troops from every direction, even at the expense of abandoning captured territory. When everything was prepared and their superior strength was assured, they turned loose their armies on the Austro-German line.

The German north flank was attacked in front opposite Warsaw, while an army from Novo Georgievsk threatened its flank. This same move was repeated at each successive position occupied by the Germans until the latter were driven back to the line of the Warta River, three quarters of the way to the border. The latest news from Petrograd claims that the Russians have now captured a part of this line at Kolo, 100 miles west of Warsaw.

This success of the Russians west of Warsaw exposed the German line farther to the south to attacks from two directions and forced this portion also to retreat to the west. The Russians crossed the Vistula and pressed their attacks upon the Austro-German lines until they have been forced back to Przedborz, Kielce, and Sandomierz. The Russians are now making great efforts to break down the resistance of this part of the opposing line. A victory here would threaten the flank of the Austrian line in Galicia and would give the Russians a chance to repeat the same moves that in September forced the Austrians to retreat to Tarnow.

The line of fighting in Galicia follows the San River to Przemysl and then strikes south through Chyrow and Stary Sambor to Turka, in the foothills of the Carpathians. On this wing the Russians have been fighting on the defensive while massing their troops to support the aggressive moves in the north. While the Austrians have made attacks at Leizaisk, Jaroslav, Przemysl, Stary Sambor, and Turka, they have been repulsed without result on the relative positions occupied by the troops. The fighting in this theater is somewhat like that along the center of the line in France, a deadlock while waiting for the outcome of the conflict in other parts of the battle area.

The fighting in East Prussia has been like that in Galicia. The Russians have, until the last few days, contented themselves with a defensive campaign. They are now taking advantage of the weakening of the German strength to press back this part of the German line also.

The noteworthy fact of the fighting in this whole theater of operations is the demonstration by the Russians of their ability to force the Germans to retreat. Neither side has yet suffered a serious disaster. The Germans and Austrians have retreated in time to save the fighting strength of their armies.

Random Reflections

By "Irresponsible"

COURAGEOUS, free, sincere thinking is the very breath of science. No other kind of intellectual activity has achieved such entirely untrammeled freedom. The scientific man recks nothing of the shibboleths which hamper the artist; his choice of problems and his choice of treatment is never open to the enervating classification which labels a thing pleasant or unpleasant. He is quite outside that point of view. A detailed analysis of tumors is not labeled unpleasant, and a detailed analysis of spectra is not labeled pleasant. Applied to scientific work that method of classification is seen to be irrelevant. It is interesting to note the reason for this, and it will then dawn upon one, I think, that the method is almost equally irrelevant when applied to works of art, especially modern art.

But there have been people who have applied this kind of criticism to science itself. A clerical gentleman once pointed out to Huxley that the theory of evolution, applied to man, was degrading and offensive. Huxley replied that his opponent had slightly misunderstood the point at issue; the doctrine might be unpleasant, but was it true? There are these two types of mind; those who seek for truth, and those who apply the jam criterion and reject all ideas which don't taste nice. The jam school has a lot more to say for itself in matters of art than in matters of science, partly because most scientific theories affect its palate neither pleasantly nor unpleasantly, but have a sort of neutral taste. Another reason is, that by sticking to provable facts instead of adopting pleasant imaginings, science has made good, and made good on such a scale that although the jam philosophers may and do occasionally rail, they dare not attack. It is true there are some gentlemen who take it as a personal slight that the planet earth is small, and that even the sun is by no means the boss star of the universe. But they comfort themselves by reflecting that mind is mightier than matter, and they imply, although their modesty usually forbids them explicitly to state, that their own minds are rather better class products than any others which are likely to have been evolved in our particular universe of about five hundred million stars.

Now I think these people are in the majority and I think that is a very bad thing. I think that a country most of whose citizens are engaged in manufacturing and consuming jam is in a bad way, even if the jam making is a source of great material prosperity. Henri Poincaré starts one of his books with the remark that the chief aim of man is to search for truth. Nine people out of ten will tell you that the chief end is to search for happiness. These are the two points of view and they split up the whole world into two kinds of people.

Most artists and men of science belong to the truth seekers and most business men belong to the happiness seekers. The second school values science for its useful applications and art for what agreeable amusement it provides. For the benefit of the devotees of happiness, presidents of the British Association make long speeches pointing out that pure mathematics, for instance, really is of some use, and that electric trams might go two miles an hour slower had it not been for some patient individual who spent an absorbed lifetime finding out how many little circles could be fitted inside a big one. Such speeches are quite unnecessary: science needs no such justification. As Poincaré points out, we have an instinct to *know;* so we proceed to find out. I feel hungry; so I eat. I don't bother to point out that by eating I add to my physical and mental efficiency, prolong my life, and continue to benefit the world by writing more columns for the SCIENTIFIC AMERICAN. I might even have difficulty in justifying my eating from that point of view; there may be people who doubt the usefulness of my activities, who think that my articles —still, we don't want to go into that.

Now, just as it is incorrect to measure science by the pint pot of pleasure, so it is, I think, incorrect to measure works of art by that standard. The problem is rather more complicated, because beauty should be an essential of art, and beauty is an extremely difficult thing to define. But literary critics of the jam school don't mean that a piece of literature is unbeautiful when they say it is unpleasant; they mean merely that things are described which make them uncomfortable. Perhaps a character in the book reminds the critic of a man who lent him $50 and expects it back; an uncomfortable thing for a professional literary critic. How often one hears the remark: "I don't know anything about art as art, but I know what I like." This is all very well for the business man, coming home tired from a busy day spent in supplying railway buffets with hard-boiled eggs, or for a successful play-producer interviewing the young and nervously perspiring dramatist who has incautiously let drop the word "art," but a professed critic with that attitude is a man unfit for his job. If a work of art is vivid, moving, beautiful, it is all right; and it is equally all right whether it be a grim, realistic study of life on a leper island, or whether it be an affecting account of two sweet children talking sentiment about their daddy in heaven. Both could be well done. I should prefer the leper island—it's more original, for one thing, but I hope I could praise the sweet children.

A Museum of Devices for the Elimination of Unnecessary Fatigue in the Industries

By Frank B. Gilbreth

BEFORE the breaking out of the European war this age might well have prided itself upon being an age of waste elimination. For a time the emphasis was all upon cutting down waste of material; but lately the emphasis has been shifted to the human element, and such phrases as "Safety First" have become the slogans of the day.

With this consideration of the human element has come the realization of the importance of fatigue, and the necessity of allowing the worker all possible opportunities to recuperate from it. Provision for such recuperation is the basis of most welfare work, which consists of providing rest rooms and lunch rooms, social halls or other places of amusement, where the worker can go before working hours, during his noon hour or afterward, to relax physically and mentally, and to get back his working strength.

In the majority of places to-day, however, it has not been recognized that fatigue is of two kinds. A certain amount of fatigue is necessary fatigue, which the very nature of the work done demands, and which can be excellently dealt with through such devices as are provided by welfare work, or by the home reading box movement and other plans of scientific management. But a large amount of the fatigue accumulated in the average day's work is entirely unnecessary, and is caused by such perfectly obvious, but often unnoted conditions, as wrong lighting or heating or ventilation, vibration, standing instead of sitting, or working at machines or benches, and on chairs or stools which are of the wrong height.

Ask any manufacturer to walk through his plant and spend a half day himself making a fatigue survey; that is, deciding just what fatigue the work done in his plant is causing, and what proportion of it is actually necessary or productive. Ask him to count how many fatigue eliminating devices he has, and to find, if he can, in how many places a study of fatigue elimination has been made. The result will astound him and you.

In order to bring this subject of unnecessary fa' ue to popular attention, we have started, in Providence, R. I., a Museum of Devices for the Elimination of Unnecessary Fatigue. This consists, at present, of but half a dozen simple devices, all but two of which have come from our own work, in spite of the fact that we have sent out tens of thousands of letters, asking for co-operation in this work. It is not that co-operation is lacking, but simply that so few such devices exist; for we have received many replies, stating, "We would gladly send such devices, if we had any, but we have never given the matter any thought."

Interest in this museum is bound to grow during this coming year, because all of the members of the second summer course of scientific management, which we conducted at Providence this summer, have promised to start museums of the same kind at their colleges. Within the last few weeks we have received letters from the three professors who came from one of the colleges to attend the course, that they have begun active steps to start their museum by appropriating money enough for the beginning, and that they felt sure that interest in it would extend throughout the entire State which they represent. This is encouraging news. The colleges have thus shown themselves ready and willing to lead the way, but extended interest and rapid progress depend much upon enlisting the co-operation of the industrial world.

Now the average American manufacturer is not only beginning to install all devices which will increase production, but he has, especially of late years, a strong realization of the importance of the human element; and certainly, as soon as he comes to think in terms of the elimination of unnecessary fatigue, our collection of devices will grow rapidly.

One of the most obvious devices for eliminating fatigue is the chair; and, if you come to Providence or visit any of the factories where the devices there exhibited are installed, you will find that the first rule followed is "A chair for every worker, whether he needs it or not."

Fatigue eliminating chairs are of various types, some of which are shown in the accompanying illustration. One type is devised in order that a kind of work which has always been done standing, may be done sitting. For example, heavy filing, which has always been considered standing work, may, through the use of a specially devised chair, be done with greater ease and the same speed and efficiency, while the worker is sitting. The chair is most inexpensive and easy of construction; is provided with a projecting foot rest, which enables the man to push the file as comfortably, sitting, as when he stands up; and is of such a height that the man can work part of the time standing and part of the time sitting.

Chairs designed to eliminate fatigue.

Another type of chair illustrated is specially devised to permit the worker to stand part of the time at work which has usually been done sitting. It is useful in rest intervals. For example, in a certain industry where cotton cloth is folded, the hour is divided into a number of work periods and rest periods, which alternate—four periods of work to one of rest, with a longer rest period at the end of the hour. During certain of these periods, the worker sits; during others, she stands. This type of chair allows her to go from the sitting to the standing period in the quickest time, and with the least amount of effort possible, and, incidentally, has proven itself so comfortable that the worker who has once been supplied with one considers it her personal property, and refuses thereafter to give it up. A third type of chair is a modification of a chair that is already in use, so that it will be the most efficient device possible for the worker using it. Many chairs, which are originally well adapted to the work and the user of the chair, become so worn in time, that the chair is neither comfortable nor useful. In this case, often, such an inexpensive and easy remedy as boring out four blocks of wood and fitting them to the legs of the chair will bring the chair back to its originally desired height.

A fourth type of chair, which will cut down fatigue, is one which eliminates unnecessary vibrations. An ordinary chair, which has shown itself useful and comfortable, may be provided with springs which relieve the operator of 100 per cent of the vibration of the floor, where the type of work done makes such floor vibration necessary. In a certain factory where such non-vibration chairs were introduced, the operators, at first, did not like them; but in at least one case, a girl who had been given this type of chair, and who was later put, for one day, back on the old kind, was so much affected by the vibration that she went home, at the end of a half day, sick.

A fatigue eliminating device is not necessarily a chair. It may well be some sort of a packet, which will bring the goods to be fabricated or assembled closer to the hand of the worker. It may be some sort of chute to carry off the finished product. But the chair is typical of the devices exhibited in and advocated by this little museum, for it emphasizes, not so much increased production, as decreased fatigue.

Road along the Connecticut River, swept by a flood.

The same spot ten days later, showing the road undamaged.

A Flood-proof Road

WATER is a great enemy to all pavements, whether it permeates through the soil under the pavement or directly through the pores of the surface. Of course the more porous the road surface the greater the effect of the water. Even excessive sprinkling that keeps the road continually in a wet or muddy condition, is injurious. Evidently, then, no more severe test can be imposed upon a road than to have it swept periodically by a flood.

The road that runs from Middletown to Cromwell, Connecticut, parallels the Connecticut River. In the spring time the floods that come down the river sweep over this road, submerging sections of it to a considerable depth. One would expect the macadam to be seriously damaged, but, in 1912, it was laid with a surfacing that is proof against such harsh treatment.

One of our photographs was taken on April 23rd last, showing the road deeply covered with the waters of the Connecticut. A similar flood was experienced in 1913. The other photograph was taken from the same spot on May 2nd, 1914, showing the road to be absolutely free from injury. No repairs were required after either flood.

A Windshield for the Motorcycle

AIR displacement of over thirty miles per hour is spoken of as a high wind, of over forty miles per hour as a gale, and of over sixty miles per hour as a hurricane.

The speed of a motorcycle varies, of course, with the condition of the road, the capacity of the machine and the speed mania of the rider; but a rate under 25 miles per hour may be considered rather slow, and the average velocity on good roads will be found somewhere between thirty and forty miles per hour. Hence the average rider, even in still air, must face a wind so high as almost to assume the proportions of a gale, and if in addition to his displacement over the road there be an opposite displacement of the air with respect to the road (in other words a head wind), the rider may experience the sensation of cleaving a hurricane. Even in the best of weather this is discomforting; but in winter the chilling effect of such a blast may produce much suffering; the lower limbs of the rider, in particular, are apt to become numb with the cold. The driver of an automobile encounters just as strong a blast, but he is sheltered by the inclosed body of the car, and usually by a glass windshield as well. Of course one cannot expect to have all the comforts of an automobile on a motorcycle, but it would seem a simple matter to rig up a windshield of light construction on the two-wheeled car, which would protect the rider from chilling blasts.

The accompanying photographs illustrate a simple type of motorcycle shield, consisting merely of a U-shaped frame clamped to the handlebars and the front fork of the machine. On this is stretched a canvas shield with a semi-circular celluloid window at the top. The shield is not so high that the rider may not look over the top of it, when he so desires. However, when assuming his normal riding posture, he will find that his eyes come on a level with the window in the shield. As an extra protection for the lower limbs, an apron is fastened to the frame of the motorcycle back of the front wheel, and extends below the foot rests. Thus the rider is completely protected by a windshield of such light construction as to add very little weight to the machine.

A windshield for the motorcycle.

Novel Uses for Automobiles

THE accompanying photographs show that an automobile may be made to serve a number of useful purposes aside from that of transportation. The motor vehicle is really a portable power plant which may be brought to the work and then by the use of simple mechanism its power may be employed to drive a machine or tool. Many commercial vehicles are fitted with attachments for such auxiliary work. One of our photographs shows a motor car used by the Boston Water Works which closes the water gates when a main has broken, much faster than it can be done by hand. When a break is reported the repair men dash to the scene as quickly as possible in the emergency car, drive to the shutoff nearest the break, and fit on their couplings as shown in the illustration, then in a few minutes the motor closes the gate. Heretofore it has taken anywhere from thirty to forty minutes to close the largest gates by hand; now they may be closed by the motor of the car in from five to six minutes.

Our other photograph shows a homemade attachment to an automobile, which consists of a sawmill. The motor car has a 15 horse-power engine, to the crankshaft of which a circular saw is geared. A platform or table in front supports the wood as it is fed to the saw. The speed of the saw is governed by controlling the motor from the steering wheel in the usual way. This sawmill on wheels is moved around from place to place, wherever there is a wood-cutting contract. Owing to the rough usage to which it was subjected the rubber tires soon gave way, and the owner has replaced them with wooden tires. As the machine is no longer used for high speed travel, these tires serve the purpose very satisfactorily. When the machine arrives at the wood pile, it is blocked in any convenient manner, as shown in the photograph, and then one attendant feeds the wood to the saw, while the other controls the operation of the engine.

A New Explosive

TESTS have lately been made in the mines of the Anaconda Copper Mining Company at Butte, Montana, of a new explosive called sabulite. It is a recent Belgian invention, and is already in use in mines of Australia and New Zealand.

The points of superiority over dynamite claimed for the new explosive are its greater strength, and its safety and freedom from noxious fumes. It is said to be from 30 to 50 per cent more powerful than 45 per cent dynamite, depending upon the age of the dynamite. It cannot be exploded except with a detonating cap, and the products of the explosion are so harmless that workmen can resume work in the face of a closed drift immediately after the blast. It does not freeze, nor deteriorate with age if kept dry. In the Anaconda tests, cartridges of sabulite were burned, bored through with a white-hot iron rod, hammered upon an anvil and shot through with rifle balls without explosion. When used with a detonating cap, however, in a very hard granite face the blasting effect of sabulite was fully equal to that produced by dynamite.

The powder is a simple mechanical mixture of nitrate of ammonia, trinitrotoluol and calcium silicide. The last-named substance is the characteristic ingredient in sabulite. It is a recently discovered product of the electric furnace. It is the comburent element in the powder, and takes the place of the powdered aluminium sometimes used in ammonium nitrate powders. Calcium silicide is a much cheaper commodity than powdered aluminium, besides being stable under ordinary atmospheric conditions. In combination with the other two ingredients, the mixture seems to produce the quick combustion and the high generation of gas necessary for an ideal explosive.

The composition of the gaseous products of the explosion of sabulite bear the following ratio in volume to each other: Water vapor, 0.60; nitrogen, 0.31; hydrogen, 0.02; carbon dioxide, 0.07. The only solid products are silica and lime. An analysis in Australia of the atmosphere of an inclosed gallery immediately after an explosion of sabulite gave the following results: Nitrous fumes, 0.0 per cent; carbon monoxide, 0.0 per cent; carbon dioxide, 0.26 per cent.

Large Air Propeller Boats

THE latest production in the way of gliding boats is the large air propeller craft which Engineer Ch. Roux is running on the Seine. It carries as many as twenty-five persons, and is built for very practical use, it being intended mainly for shallow streams in the colonies where ordinary craft cannot run, aquatic plants being another disadvantage which is not felt by the gliding boat. The body is of steel, 26 feet long and 3 feet wide, the draft being only 10 inches for a two-ton load. A 60 horse-power Rossel gasoline motor of four-cylinder type drives the aerial propeller by chain, it being placed at the extreme after end of the boat. Propeller is of wood and four-bladed, about 9 feet in diameter, and runs at 800 revolutions per minute. When fully loaded, the total weight is 4.5 tons, and speed can reach 12 miles an hour. The motor is mounted forward under a hood which shields the pilot, while a light canvas roof is stretched over the middle of the boat, with cross benches for the passengers. Trials with the colonial glider on the Seine were so satisfactory that the inventor is now engaged in designing a larger craft on the same lines, which is to be 60 feet in length, and will carry a load of 15 tons. It is intended for use in the French colonies on the Mekong River.

Emergency car closing the gate of a water main.

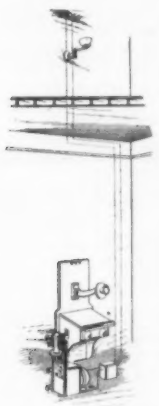
Automobile fitted up as a portable sawmill.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Electrical Devices.

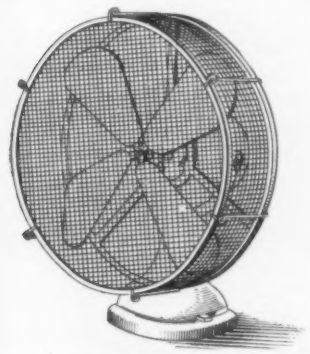
SAFEGUARD LIFE AND TELEPHONE ATTACHMENT.—I. E. ROSENTHAL, 402 E. 2nd St., Argenta, Ark. In this patent the aim is to provide mechanism for installation in homes, hospitals, factories, warehouses and the like, for protecting and safeguarding lives and



SAFEGUARD LIFE AND TELEPHONE ATTACHMENT.

property in case of fire, wherein means is provided for automatically sounding an alarm and at a time before the fire has gained too great a headway to be extinguished.

ELECTRIC FAN SCREEN AND GUARD.—B. F. FRITTS, 619 Market St., Chattanooga, Tenn. The screen is preferably constructed with a front member having rearwardly extending portions so that the front member will guard the front and sides of the fan. The rear of the screen which is detachably secured to the extending portions of the front screen member



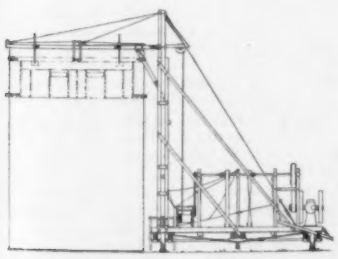
ELECTRIC FAN SCREEN AND GUARD.

may be permanently secured to the fan motor casing, or, if desired, this rear screen member may be constructed in sections which are hinged together and which may be disposed around the fan for guarding the rear of the fan when the rear screen member is secured to the rearwardly extending portions of the front screen member.

CURRENT MOTOR.—J. W. LAURENT, S. 673 Stone St., Spokane, Wash. This invention relates to a motor supported on a floating structure and adapted to be raised and lowered relatively to the stream, the motor, when lowered, presenting a broadside upstream. Means provide for raising and lowering of the motor for the proper bracing of the frame parts and the motor.

Of Interest to Farmers.

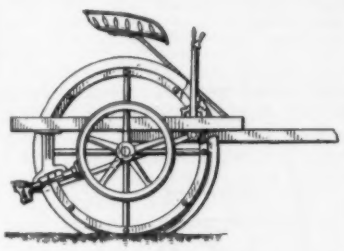
HAY AND GRAIN STACKER.—J. M. HARVEY and J. A. HARVEY, Ogden, Kan. The invention relates to stackers for hay, grain, straw, leaves and the like, and possesses a



HAY AND GRAIN STACKER.

number of distinct advantages, being especially adapted for forming stacks of large size and being easily operated by aid of a minimum expenditure of labor. An engine supplies power both for shifting the position of the machine and for raising and lowering the jointed platform.

CULTIVATOR.—A. RASMUSSEN, Edgemont, S. D. This invention relates to improvements in cultivators, and particularly to a corn cultivator, and has for an object the provision of an improved structure which is designed for



CORN CULTIVATOR.

use in what is known as dry farming, so as to maintain the soil in proper condition, and to reduce the foliage of the corn to a minimum, whereby the strength may go into the stalk and ear. Means provide for raising or lowering the cutter so as to adapt the same to corn of various ages.

SHEAF HOIST AND CHUTE.—W. G. FETROW AND E. EBERLY, R. F. D., Box 8, Mechanicsburg, Pa. This refers to an apparatus more particularly intended for elevating sheaves of unthrashed grain to barns or other outbuildings, or onto stacks or mows. The invention contemplates also a chute so arranged as to distribute the sheaves over the mow or room.

Of General Interest.

MATTRESS DISPLAY RACK.—A. FISHER, 1305 So. Lamar St., Dallas, Tex. In the present patent the invention has reference to mattress racks in which slidable trays are adapted to be projected beyond the front of the rack and supported in a tilted position for the proper display of the mattress.

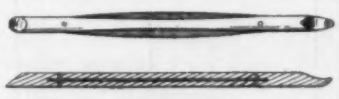
PACK HARNESS.—H. H. HAUGHT, care of W. H. Hilligass, Payson, Ariz. This invention has reference to a harness for securing packs on pack animals, and an object of the improvement is the provision of a pack harness which may be conveniently manipulated, and by means of which the packs will be properly held in place on the animal.

FILTER.—U. HOKE, Cornwall, Pa. Mr. Hoke provides a filter especially adapted to be attached to the discharge pipe from the collecting surface, as, for instance, a roof, and to be arranged between the said collecting surface and the cistern and having means for thor-

FILTER.

oughly purifying and clarifying the water before admitting the same to the cistern, and also having means for deflecting the first water discharge from the collecting surface out of the filter and away from the cistern.

MANICURE STICK.—H. C. GIBSON, Little Rock, Ark. The aim in this case is to provide a device wherein a support is provided for holding an abrading device, as, for instance, a file for abrading the finger nails in such man-



MANICURE STICK.

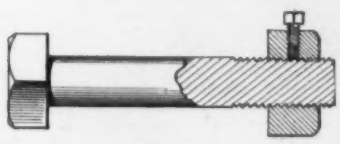
ner that while the abrading surface is held in a manner to be easily accessible, a guide is furnished for guiding the nail during the abrading operation and for limiting the extent of the nail which may be abraded.

Hardware and Tools.

MATCH HOLDER.—J. F. O'MALLEY, 126a W. 127th St., New York, N. Y. The improved match holder is more especially designed for holding a bunch of paper or wooden matches, and arranged to allow of conveniently fastening the bunch of matches in place and allow ready removal of a match whenever desired.

SPRING CLIP.—T. I. A. TOMASINI, Cayucos, Cal. This invention provides an auxiliary spring or spring clip to be attached to a leaf spring for keeping the leaves in place and to augment the resiliency of the leaf spring. It also provides an auxiliary spring simple in construction and inexpensive to manufacture.

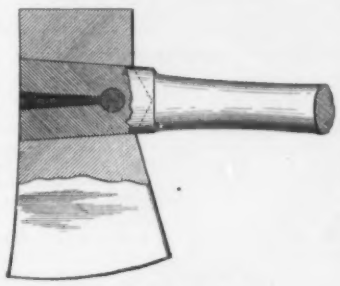
NUT LOCK.—G. BREAULT, 350 Mineral Spring Ave., Pawtucket, R. I. This invention comprises, in combination with a threaded bolt, a polygonal nut applied thereto and provided at one of its sides with a radially threaded bore, and a locking screw in the bore and hav-



NUT LOCK.

ing its inner end provided with cross-wise grooves arranged at an angle to each other and forming four points that take into the adjacent grooves of the bolt and straddle the thread between the said grooves.

HANDLE FASTENING.—I. G. BURTON, 1181 Broadway, New York, N. Y. The object of this invention is to provide a new and improved handle fastening more especially designed for fastening handles in hammers, axes, hatchets

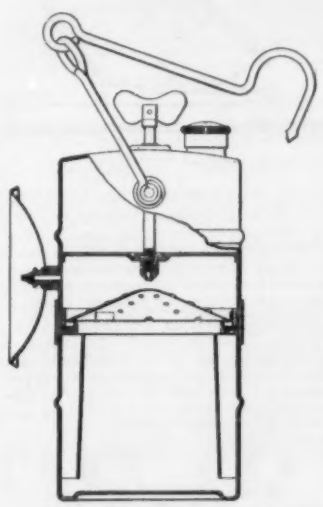


HANDLE FASTENING.

and other tools and devices, and arranged to permanently fasten the handle in place in the socket of the tool and without unduly weakening the handle.

Heating and Lighting.

MINER'S ACETYLENE LAMP.—Y. OHTSUKA, 66 Mita Toyookacho, Shibo, Japan. The object of this inventor is to obtain a lamp to maintain the action of lighting always perfect even should the lamp shell be deformed by severe shocking or dropping, or careless treat-



MINER'S ACETYLENE LAMP.

ment in mines, and to hold the connection of two parts perfectly air tight by keeping the connecting part in a continuously wet state by the water dropping down from the water chamber to the gas generating chamber, whereby the escape of gas is prevented.

ELECTRIC HEATER AND HUMIDIFIER.—W. C. SMITH, Twin Falls, Idaho. The invention refers more particularly to a combined heater and humidifier whereby vapor is generated by the heating elements of the heater and caused to mix with the heated air so as to temper the same and prevent the objectionable dryness of air heated by an ordinary electric heater.

SHADE HOLDER.—F. REUTTER, care of H. GOODFRIEND, Room 512, 6 East Lake St., Chicago, Ill. This invention relates to shade holders of that type disclosed in U. S. Letters Patent No 1,039,519 formerly granted to Mr. Goodfriend, and the general objects are to improve the construction of shade holders of the character referred to, so designed as to firmly grip lamp shades which may vary in size within certain limits.

LIQUID FUEL BURNER.—G. E. DENMAN, 355 Custer St., Fruitvale, Cal. This improvement pertains to burners through which liquid fuid is forced out into a fine, evenly subdivided spray, the particles of which are made to intermingle with the fluid used, and by means of which fluid the atomizing of the liquid fuel is obtained.

Household Utilities.

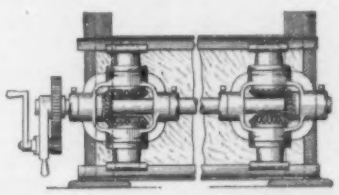
CHAIR, SOFA, AND SIMILAR FURNITURE.—E. A. HOFSTATTER, care of Hofstatters Sons, Inc., 362 Second Ave., New York, N. Y. The intention here is to provide improvements in upholstered chairs, sofas and similar furniture, whereby an adjustable upholstering slat for the back frame is provided to enable the upholsterer to raise or lower the said slat according to the nature of the seat to be placed on the furniture.

SANITARY DISH HOLDER.—D. F. CURTIN, Address the Vortex Mfg. Co., 412 Orleans St., Chicago, Ill. This holder is for holding dishes of paper adapted to contain ice cream, sundaes or the like, so arranged that a sheet of paper cut to the proper shape may be inserted in the holder so that no part of the contents of the dish will contact with the material of the holder, and wherein the holder is so arranged that every part thereof may be easily cleansed after the used dish has been removed.

Machines and Mechanical Devices.

APPARATUS FOR TUBULAR TRANSFERRING SYSTEMS.—L. LOEBENBERG, 60 Rua da Alfandéga, Rio de Janeiro, Brazil, S. A. This apparatus is for use as a sender, receiver, or as a passage apparatus (intermediate station) for tubular transferring systems. It consists essentially of a rotary gate, or valve device by the rotation of which the system is tightly closed from the atmosphere and the introduction and removal of the cylinders or boxes is still made possible.

STRETCHER.—S. W. DODGE, Fitchburg, Mass. This stretcher is for use in stretching various flexible materials, such as felt. It is constructed with an operating shaft on which are mounted any desired number of means for moving away from the shaft, heads which carry the stretching irons. The stretcher is

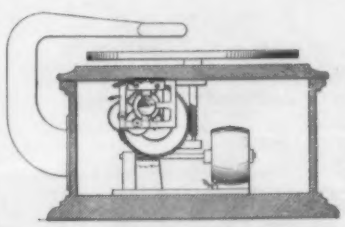


STRETCHER FOR FLEXIBLE MATERIALS.

preferably supported in a stand for preventing its rotation with its shaft, the shaft being disposed horizontally for rotation by a crank and gearing. The stretcher is especially well adapted for stretching jackets for couch rolls used in paper-making machinery.

SHREDDING MACHINE.—S. T. STUVER, El Cajon, Cal. The principal object here is to provide a vegetable shredder comprising a suitable casing with a rotatable shredding element mounted therein, this shredding element taking a plurality of forms whereby different degrees of shredding may be obtained.

AUTOMATIC WINDER FOR SPRING MOTORS.—F. J. C. FREDERICK, 379 Forest St., Jersey City, N. J. This invention has particular reference to means for automatically keeping the springs wound so as to relieve the operator from special attention and enable the machine to be actuated continually from the



AUTOMATIC WINDER FOR SPRING MOTORS.

spring motor. It provides a self-winding device for a spring motor, such device to include an electric motor with a make-and-break device to start and stop the motor in accordance with the extent of the winding and unwinding movements of the spring or springs.

EXIT DOOR CONTROL.—W. I. RESNIKOFF, 288 Pulaski Ave., Brooklyn, N. Y. To obviate objections, this inventor has devised a door structure which automatically unlocks when the same is approached from the interior side, in which the means for unlocking the door remain inoperative as long as the door remains open, and automatically become operative as soon as the door is closed.

PAPER CUTTING AND FOLDING MACHINE.—F. P. HILDEBRANDT, 77 Partition St., Saugerties, N. Y. Among the principal objects of the invention is to provide a power driven automatic machine which will receive paper from a roll or rolls, slit the same into a plurality of strips, and then cut and fold the squares or sections of each strip to form, in

rapid succession, folded napkins of any suitable form.

MEANS FOR GOVERNING THE SPEED OF WIND MOTORS.—A. P. TURNBULL, "Romsey," Victoria St., Randwick, Sydney, New South Wales, Australia. In this invention the various improvements are effected by vertically hinging the tail piece to the pivoted head frame, and positioning the wind wheel at such a distance forward of the axis of the pivot that the wind pressure acting on the surface of the wind wheel imparts a predetermined effort to the same to rotate about such pivot and toward the hinged vane, which latter remains parallel in the direction of the wind, the effort mentioned being effected against an adjustable counteracting factor, such as a weight or spring.

SPEED CHANGING DEVICE.—A. FRETZ, Edmond, Okla. An object here is to provide a speed governing device in which the speed may be controlled by the movement of the same lever. A further object is to provide a device in which any speed from a minimum speed to a maximum speed may be secured by the movement of the same lever.

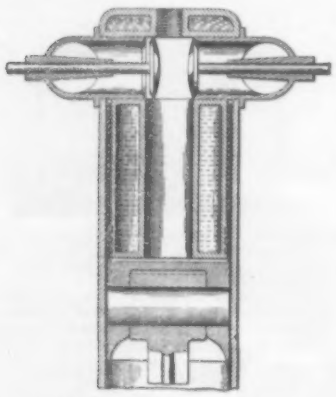
DRILL.—W. J. TURNBULL, deceased. Address H. W. Hille, Room 306, Wells, Fargo Bldg., New Orleans, La. The motor in this device is provided with means for anchoring the same from rotation in the well casing, the said means being electrically operated and releasable at will, and wherein a peculiar form of cutting blade or knife is provided, so arranged that when in operation and actually cutting, the said blades will be extended beyond the peripheral surface of the well casing to undercut or underream the same, which when not cutting and not in contact with the material to be cut, may be moved into contracted position by the mere lifting of the drill.

DRILL.

Prime Movers and Their Accessories.

CARBURETER.—D. MC RA LIVINGSTON, Manhattan, N. Y., N. Y. In the present patent the object of the invention is the provision of an improved form of carbureter, which will serve for the production of a proper fuel mixture under the conditions of operation of the engine.

INTERNAL COMBUSTION ENGINE.—J. M. BAILEY, Chiclana and 25 de Mayo, Bahia Blanca, Argentina. The invention provides improvements in internal combustion engines, whereby the piston, the cylinder, and the parts in the crank case may be readily oiled without danger of the lubricant passing into the combustion chamber and being burned therein.



INTERNAL COMBUSTION ENGINE.

Use is made of a water-jacketed cylinder head providing a combustion chamber in the said cylinder and spaced from the inner surface thereof to form with the cylinder an annular space and a piston reciprocating in the said cylinder and having a tubular extension passing into said annular space.

Railways and Their Accessories.

DOOR SILL EXTENSION FOR SUBWAY CARS.—C. M. SWEDBERG, 13 Willow Place, Yonkers, N. Y. More particularly, the invention relates to sill extensions at the doors of subway and elevated railroad cars so as to bridge the gap between the sides of the car and the edge of the station platform, in order to avert accident by passengers stepping into a space between the platform and door sills on entering or leaving the cars.

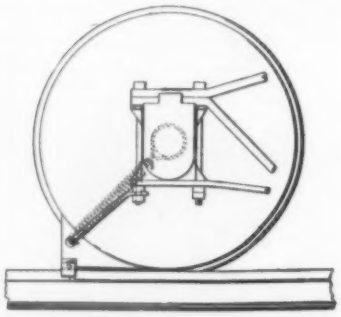
DRIFTING VALVE.—C. JAMES, 90 Newall Ave., Rutherford, N. J. This invention provides means for supplying low-pressure steam to the cylinder of a locomotive while the same is drifting, the supply being diminished and determined as the progress of the locomotive diminishes and ceases; and provides means, operated mechanically in unison with the moving parts of the locomotive, for controlling the supply of steam to the cylinders.

CAR FENDER.—J. T. FULMELE, 1107 Kirkwood St., Wilmington, Del. In this device the forwardly projecting frame of the fender will be tilted downwardly when an object falls upon the fender, thereby preventing the frame and the car from riding over the object. Means provide whereby the air brakes are set whenever the fender strikes an obstruction, such as an animal or a person, thus stopping the car automatically.

RAILWAY TIE.—C. SCHAFFER, Florence, Arizona. The objects in this case are to provide a metallic railway tie, together with a novel arrangement of supporting blocks therefor, as well as tie straps to be employed in connection with the ties and blocks at the joints, the purpose being to form a substantial support for the rail; to provide for assembling the parts so that a proper alinement will result; and to afford an effective bracing means for the rails and for resisting the contraction and expansion of the rails.

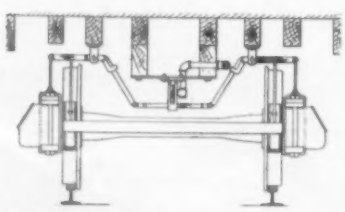
RAILWAY TIE.

TRACK CLAMP.—T. N. ROBINSON, Box 134, Waterford, N. Y. This invention relates to track clamps or grips used in connection with railway tracks and truck wheels. The device is for use in connection with a truck wheel whereby the clamp will automatically act between the wheel and the rail to prevent movement of the wheel or truck in the direction of the clamp. An advantage of this device is with respect to its reliability of operation and facility with which the biting element thereof may be renewed or replaced or with which the entire clamp may be detached or swung out of the way when not to be used for a clamping purpose.



TRACK CLAMP.

SAFETY APPLIANCE FOR RAILWAY CAR TRUCKS.—F. G. WILLERS, 120 Hersey St., Cadillac, Mich. Mr. Willers's invention is embodied in mechanism applied to a car-truck, whereby the air brakes are applied in case a car wheel leaves the rail or a brake-beam drops, or axle bearings become displaced. His invention is embodied in a mechanism which operatively connects certain parts of the truck with the valve lever, so that the latter is raised and the valve opened when some of such parts become displaced.



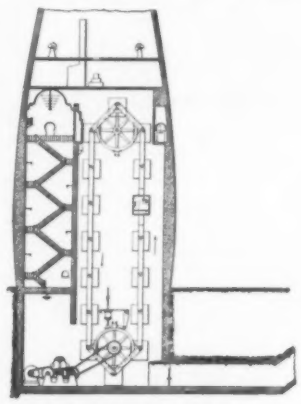
SAFETY APPLIANCE FOR RAILWAY CAR TRUCKS.

CAR FENDER.—A. T. GOOKIN, 50 Dana St., Cambridge, Mass. An object of this inventor is to provide a street car fender adapted to be swung to a raised position and held in compact form when not required for use, but which will possess such rigidity, when lowered, as to resist any tendency to roll up or rise when striking a person.

SMOKE FILTER AND SPARK ELIMINATOR.—E. H. GAGNON, 116 House Bldg., Pittsburgh, Pa. This improvement is in devices for filtering smoke and eliminating sparks from locomotives and the like, and has for an object to provide a structure which will filter and clean smoke from a locomotive previous to its discharge without affecting the usual draft provided.

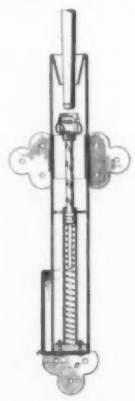
Pertaining to Recreation.

AMUSEMENT DEVICE.—E. C. MANTEROLA, Casella No. 27, Rancagua, Chile, S. A. This device produces the imaginary effect of an aerial trip to a distant planet on a projectile supposed to be projected from the structure, which is in the form of a cannon having its muzzle pointed upwardly, while it is nothing more than a car mounted within the structure and has a movement accompanied with an explosion, so that the participants will imagine their projection through space, and at the end of the flight they leave the car and enter a hall or cavern of fantastic scenes of an imagined planetary destination, and thence an exit to the street.



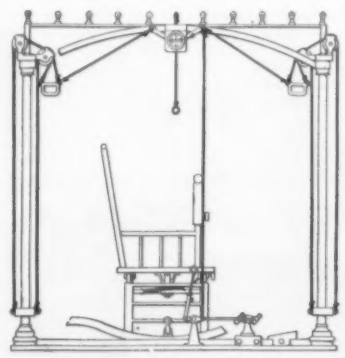
AMUSEMENT DEVICE.

DEVICE FOR CHALKING CUES.—H. H. LEECE, 72 East Third North, Portland, Ore. One of the principal objects here is to provide a device which may be attached to a suitable portion of a billiard table, and which may be used to automatically chalk the billiard cue tips. The invention embodies means whereby the chalk dust may be caught and delivered to a suitable receptacle.



DEVICE FOR CHALKING CUES.

EXERCISER.—E. A. FRIEDLI, 605 Prospect Ave., Canton, Ohio. The apparatus provides a wide range of exercises and are readily adapted to adults of both sexes and children. The necessary adjustments are provided to accommodate the apparatus to the size of the user. It makes possible not only effective pedal and arm exercises, but complete bodily movements, since the occupant of the chair in gripping the hand holds or the trapeze, and utilizing the pedals or foot rest, may perform various body movements.



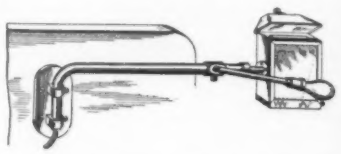
GYMNASIUM EXERCISER.

BAIT HOLDER.—C. W. LANE, Madrid, N. Y. This invention consists in the improved holder proper for live bait, especially minnows, and in an attachment of the same comprising barbed hooks, which are released from the holder proper when a fish is impaled on them in the act of seizing a minnow.

GAME APPARATUS.—J. W. HANLEY, care of A. Stamm, 216 E. 18th St., New York, N. Y. This invention relates to games and toys and has particular reference to games of an educational as well as an amusing nature, and hence adapted especially for use by young children. The game provides for teaching the ultimate victory of good over evil or the optimistic domination of right conduct over evil conduct or influences.

Pertaining to Vehicles.

CHECK HOLDER FOR AUTOMOBILE DRIVERS.—D. JOSEPH, 108 W. 139th St., New York, N. Y. The check holder is mounted on the automobile at a suitable position, as, for instance, the dashboard, so that the attendant at the hotel, theater, or department store can deposit the driver's check into the holder,

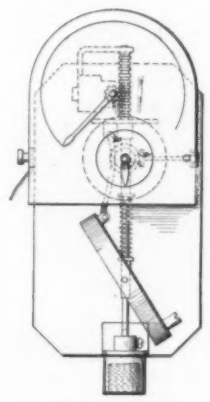


CHECK HOLDER FOR AUTOMOBILE DRIVERS.

where it is always in view, and as it is not given into the possession of the driver, there is no danger of its being lost. When the driver is signaled to return and take away the patron having the corresponding check, the holder may then be opened by either the attendant or the driver. The check drops out and is then annulled.

SANDING DEVICE FOR AUTOMOBILES.—C. L. LINCOLN, care of Dept. Parks, 2823 Clarendon Road, Brooklyn, N. Y. This invention provides a device to discharge fine gravel, dry, coarse sand or a similar dry, non-packing material, onto a roadway immediately in front of the bottom portion of the tires of the rear or drive wheels to prevent the vehicle from skidding on a slippery roadway.

SPEED MEASURING AND CONTROLLING DEVICE.—J. H. CORE, 600 3rd Ave., Nashville, Tenn. This invention provides means for accurately indicating the speed of a vehicle and for enabling the user of the vehicle to set the device so that it will automatically control the speed. The device is primarily designed to be used with the ignition circuits of automobiles having internal combustion engines or with the motor circuit of electric automobiles.



SPEED MEASURING AND CONTROLLING DEVICE.

Designs.

DESIGN FOR AN ELECTRIC BRACKET LAMP.—C. KAUFMAN, Santa Ana, Cal. In this ornamental design the bracket and lamp comprise lines of original and graceful form, the electric bulb being seated in an attractive bowl-shaped shade.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AGENTS

AGENTS—Here's a whirlwind seller. Every family needs it. No limit to money you can make. No competition. Sample free. For full particulars address Dept. V, W. E. Co., Delta, Colorado.

BUSINESS OPPORTUNITIES

A FIRST CLASS BRICK YARD with all facilities for turning out fireproofing tiles and bricks of all kinds, including inexhaustible clay deposits of the finest grade, adjoining yard. Executrix must lease or sell property immediately. Address O. D. M., P. O. Box 773, New York.

WE ARE IN A POSITION to finance, make and sell any article in the metal line, preferably of brass. If you have such an article send full particulars to Post Office Box 369, Cleveland, Ohio.

INSTRUCTION

FREE TUITION BY MAIL. CIVIL SERVICE, Normal, Academic, business, agricultural, English, drawing, engineering, real estate, and law courses thoroughly taught by mail. For "free tuition plan" address Carnegie College, Rogers, Ohio.

PATENTS FOR SALE

FOR SALE. Patent on "Case Cartridge," useful as sheet music holder or drawing case. Must be colored like a rifle cartridge, ferrule inch handles white color. John Jorg, Camp 4, El Portal, Cal.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.
MUNN & CO., INC.

Inquiry No. 9389. Wanted the name and address of manufacturers of valves, cylinders, recording gages, filling and weighing stands and all material and appliances which enter into the manufacture, transportation and sale of compressed gases.

Inquiry No. 9390. A syndicate of gentlemen desire to get in touch with an inventor or manufacturer of some small patented article with a view of placing the same on the market. Large capital and expert sales force if the invention or article stands examination. Automobile specialties preferred.

Inquiry No. 9391. Wanted the name and address of makers of plants for the utilization of by-products from sawdust, also waste wood.

Inquiry No. 9392. Wanted the name and address of the owner of some good patented article open for sale on commission or specified territory. The article to retail from $5.00 to $10.00.

Inquiry No. 9393. Wanted the name and address of someone who has an article which could be made in a large Hickory Handle plant.

Inquiry No. 9394. Wanted the names and addresses of firms that deal in machinery for manufacture of plaster of Paris and drying by hot air.

Inquiry No. 9395. Wanted names and addresses of manufacturers capable of manufacturing cloth Boards (made of paper, wood, and metal) also sample books. One who is able to turn out unlimited quantities at right prices.

Inquiry No. 9396. Wanted the names and addresses of makers of furnaces for reducing carbonate of barium to oxide, electric or otherwise.

Inquiry No. 9397. Wanted the name and address of a manufacturer of a machine that will automatically dose and fold powders and other preparations.

Inquiry No. 9398. Wanted the name and address of a manufacturer of a machine to print and label lead pencils and pen-holders.

Inquiry No. 9399. Wanted the name and address of workers in ornamental polished stone.

Inquiry No. 9400. Wanted to buy an insoluble, non-fusible and opaque plastic material to be used in die moulds for manufacturing tobacco pipes of special kind.

Inquiry No. 9401. Wanted the name and address of the owner of a second hand aeroplane motor from 20 to 30 H.P.

Inquiry No. 9402. Wanted the name and address of a manufacturer who can make a tin toy.

Inquiry No. 9403. Wanted the name and address of a glass manufacturer who can blow a small glass article to order.

Inquiry No. 9404. Wanted the name and address of a manufacturer of a tool for cutting nicks in plate glass used for name plates and house numbers.

Inquiry No. 9405. Wanted the name and address of a manufacturer who is able to supply an attachable eyelet, aluminum or celluloid through which a snap fastener would work.

Inquiry No. 9406. Wanted the name and address of a manufacturer who can supply insole material in rolls The material seems to be scrap leather composed and attached to a canvas bottom.

Inquiry No. 9407. Wanted the name and address of some patented mechanical device which saves money or time or both, which if properly handled will bring a large demand. It must not be too expensive. It may be electrical as well as mechanical. A first class article desired.

Inquiry No. 9408. Wanted the name and address of a manufacturer or distributor of a machine which will clean both single and double burlap bags; especially heavy bags.

The Electrical Measurement of Star Light

(*Concluded from page 408.*)

bodies complete the circuit around the common center of gravity in only a few days, in some cases less than one day, and in one system the period is only five hours!

The North star, or Polaris, as it is called, has a companion which goes around in about four days, and one of the first questions asked when the spectroscope revealed this second body was: Does Polaris vary in light due to the presence of this companion? This problem has been attacked by practically all methods, visual, photographic, and electrical, and all agree that the North Star is continually fluctuating about its mean brightness in a period of four days. The extreme range is about 10 per cent, and while this change is undoubtedly due to the companion, the exact influence of the second body is not understood. This light-variation of Polaris is quite similar to that of numerous other objects in the sky, many of which vary 50 per cent or more, and the determination of the cause of variability in one star will probably lead to an understanding of them all.

There is another kind of star, however, where the influence of a companion upon its light is well understood. Suppose the second body happens to go around in a plane which passes very near or through the position of the earth. Then every time the companion passes in front of the main body there will be an eclipse, and the star will appear fainter to us. Measures of such stars are especially within the province of the selenium photometer, and in Fig. 3 is shown a system which has been observed with this instrument. The star is Beta Aurigae, that is, the second brightest star in the constellation Auriga, an object in the winter sky about as bright as Polaris. The spectroscope shows that here we have not one body but two practically equal in size and brightness, which go around in a common circular orbit in just less than four days, or 95 hours. The plane of the orbit is slightly tipped, but during six hours there is an eclipse, which is repeated 47½ hours later when the positions of the bodies are interchanged. The dotted circles show the bodies at the maximum eclipse, when 7 per cent of the combined light is lost, and therefore when 7 per cent of the total apparent area of the two disks is occulted from one of them by the other. From the duration of the eclipse as compared with the total period of revolution it may be calculated that the distance between the two spheres is 6.8 times the radius of each. Now from the spectroscopic results the size of the orbit in miles is known, and with other data as to the distance of the system from us we are able to compute the results for comparison with our sun. In the figure, which is all drawn to scale, the smaller shaded circle represents the sun, and it shows that each component of Beta Aurigae is a giant even when compared with our own mighty orb. Each body has 2.6 times the diameter and 2.4 times the mass of the sun, but is only one seventh as dense. It is in light power, however, that the results are the most striking, as each body emits one hundred and fifty times the sun's light, or a total of three hundred times for the two! Let the reader imagine, if he will, the dazzling appearance of such a system, each star intensely white, and beside which our yellow sun would be almost dark.

The foregoing case has been selected as showing what can be inferred about a stellar system when the necessary data are obtained. In other cases the two bodies may be unequal as to size and brilliancy, but in Beta Aurigae the conditions are most favorable and the data most complete, and it is no exaggeration to state that we know more about this star than any other in the sky; also the size and weight of each component have been measured by an electrical method.

Even in astronomy the modern technical advances are being used, and the astronomer can derive electrical power from a heavenly body, although he has not as yet literally hitched his chariot to a star.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13028) W. J. C. asks: Kindly answer the following question: A weight suspended from a wire (say a cubic foot of iron) how much less does it weigh when immersed in water (say sea water), and how is the difference in weight computed? Also, will it weigh any less when immersed to greater depths? A. A cubic foot of iron when immersed in water will displace a cubic foot of water, and will weigh as much less as the water weighs which it displaces. This is in accordance with the Principle of Archimedes, which is: "A body immersed in a fluid is buoyed up by a force equal to the weight of the fluid displaced by it." Fresh water weighs 62.4 pounds per cubic foot at 39 deg. Fahr., and sea water weighs about 64 pounds per cubic foot, so that a cubic foot of iron, or anything else, would lose the weights given above upon immersion in fresh or salt water.

(13029) H. S. S. asks: I would like to have your answer to the following question: Was gunpowder discovered or invented? This question came up in high school; some say it was invented, some say discovered. A. To determine whether gunpowder was discovered or invented you should first learn from the dictionary what a discovery is and what an invention is. You will find that a discovery is the act of finding out or bringing to knowledge what was unknown, but which was in existence; for example, the *discovery* of America. America was where it is now, but was not within the knowledge of the world. Columbus discovered it. Invention is the act of finding out how to make something previously unknown, or to do something in a new and different way; as for example, the *invention* of printing. The idea in invention is noveity, the thing or process invented did not previously exist, so far as the inventor knew. The Century Dictionary has this statement: "The invention of gunpowder in Europe has been ascribed to Roger Bacon and to a German monk named Schwartz." The Encyclopedia Britannica, under "Gunpowder," has this statement: "It is probably quite incorrect to speak of the *discovery* of gunpowder. There is not sufficient solid evidence to pin down its invention to one man." Bertold Schwartz was generally considered to be the inventor of gunpowder. This should enable you to settle the question.

(13030) E. J. F. asks: Will you kindly advise me if water boils quicker at an elevation, as well as at a lower temperature? A. Water can be boiled in less time at a high elevation because it boils at a lower temperature. Its temperature does not have to be raised through so many degrees as at a lower altitude.

(13031) R. R. asks: Will you be so kind as to give me information where I can get an instrument to locate silver or gold? I have reliable information that money has been hidden in the ground and I want an instrument or dipneedle to locate the same. A. We do not know any instrument which can locate buried gold or silver. We are receiving so many requests for such an instrument that we print this inquiry and reply so that all may see it and be saved the labor and trouble of writing us on the subject. A dip needle is a magnet, and no magnet has the slightest attraction for either gold or silver.

(13032) A. K. D. asks: Could I, as a reader of your valued columns, get a little information on painting or blackening brass? A. In most of the processes for blackening brass the article is dipped in the solution and heated to set the color. A black to be applied with a brush may be made by adding fine lamp black to brass lacquer or fine shellac varnish. When dry it may be polished by rubbing gently with paraffine on a soft cloth. This will probably not last any longer than the paint which the company have furnished you. All such coatings crack off from metal which is handled very much. Our "Cyclopedia of Receipts" gives eleven processes for blackening brass. We send it for $5.

NEW BOOKS, ETC.

THE THEATER OF MAX REINHARDT. By Huntly Carter. New York. Mitchell Kennerley. 1914.

The contemporary stage is a kind of picture box within which characters must move and talk. Although the actors are alive and strut about with a certain degree of spontaneity, a theatrical production, such as most of us know it, is in reality a magnified puppet show. Even though much ingenuity is expended on well constructed properties and well painted scenery, it is difficult to create the artistic illusion of reality. As much is demanded of the spectators as of the actors; for the spectators are asked to believe that this three-walled picture box into which they are gazing is in reality a four-walled room, that the hero comes and goes as he does in a perfectly natural manner and not because he is constrained to come and go in a conventional way by entrances and exits limited in number and position.

No matter how we change the theater, there will always be some such limitations upon the dramatist and the theatrical artist; but that is no reason why we should adhere to the human puppet show which we inherited from the Italians, and which is used for every kind of drama, old and new, whether it be a saucy dialogue by Shaw or a tragedy by Shakespeare.

Max Reinhardt has made a deliberate and artistic attempt to release the theater from its old thraldom. In his theater the spectator is not merely an onlooker, but almost an impersonator; for he is made to feel that he is part of the drama that is being enacted before his eyes. In order to project the spectator into the action, Reinhardt converts the stage into an arena. In a word, gives it that fourth wall which it has hitherto lacked. Hence auditorium and theater are practically one. Since the spectator is no longer contemplating an animated picture, since the actors are thrown almost in the very midst of the audience, painted canvas is all but abandoned. Instead we have solid doors, walls and roofs—real three-dimensional structures which must be designed by an architect rather than by a scene painter. This change in the character of the setting has brought about with it a change in lighting. The play of light upon neutral tinted surfaces focuses and accentuates the emotions more effectively than colored pigment.

Since the picture box stage has given place to the arena stage in the Reinhardt system, the act interval cannot be the same. To reduce the act interval has been a great problem. Reinhardt has met it by using the revolving and the sinking stage, as well as by employing the Greek device of intervals filled in by a chorus.

All this seems very mechanical, a contribution to stage architecture rather than to dramatic art. Yet Reinhardt has in reality given the drama a free rein, and encouraged a type of play which, in a sense, never had full scope upon the old stage. In a picture box real action is so limited that the audience must forget or overlook ridiculous conventions; in the Reinhardt arena a vast horde can rhythmically flow in and out, sway back and forth in a torrent of life. Hence the Reinhardt theaters must mean a revival of that type of Greek drama which reveals elemental human passions. We shall have action where hitherto we have had mere talk.

Of the conception and development of this new type of theater and drama, Mr. Carter has given us a very interesting and vivid picture. His book must prove an intellectual stimulus to every thinking lover of the theater.

MOTORCYCLES, SIDECARS AND CYCLECARS. Their Construction, Management and Repair. By Victor W. Pagé, M.E. New York: Munn & Co., Inc. 550 pp.; 350 illustrations. Price, $1.50.

Those who have read Mr. Pagé's book on the automobile will welcome this volume on the motorcycle, in which he treats his subject with his usual thoroughness and clearness. Previously to this there has been nothing of a competent nature published in this country on the motorcycle, but in Mr. Pagé's book every detail of motorcycle construction is carefully explained, including power plants of both two and four cycle design, and various systems of carburetion, ignition and lubrication. Clutches, speed change gears, starting devices and brakes are fully covered and illustrated by many engravings of the best American and foreign machines; while for those who require technical information many useful tables and formulæ are given. Sidecars are fully covered, and a chapter is devoted to the cyclecar that is instructive. While the matter covered is mainly descriptive and explanatory, some space has been devoted to the practical questions of operation and maintenance. As a whole, it is a useful book of reference, and by far the best of its kind yet published.

THE BEGINNER'S GARDEN BOOK. A Text-Book for the Upper Grammar Grades. By Allen French. New York: The Macmillan Company, 1914. 16mo.; 402 pp. Price, $1.

Now that the garden enters so largely into the school life in many institutions of learning, it is not unreasonable that a special text book is required. The volume before us is well illustrated and well printed, and will tend to give the students an excellent idea of the fundamentals which underlie gardening, and will result in an awakened love of flowers and an understanding of the economic value of vegetables. The book will be of special value when the children are brought into direct contact with nature, and they must necessarily profit mentally and physically. In many places children are kept busy who otherwise might be idle through the weeks of vacation. They learn to work and they understand the values created by work, and they gain from this both self-respect and respect for property. Gardening thus becomes a lesson in civics. In addition, in country towns intensive agriculture, our dependence in the future, must be stimulated by gardening. The garden movement is, for all these reasons, of even national importance. The volume before us covers not merely the school work indoors and out, but also the work of gardening at home.

TELEPHONE CONSTRUCTION, INSTALLATION, WIRING, OPERATION AND MAINTENANCE. By W. H. Radcliffe and H. C. Cushing, Jr. New York: The Norman W. Henley Publishing Company, 1914. 24mo.; 223 pp. Price, $1.

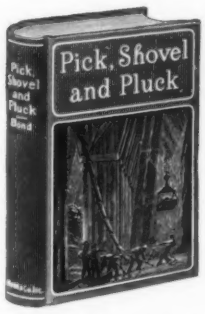
This book describes and illustrates up-to-date methods of telephone practice, including the principles of construction and operation of telephone instruments, approved methods of installing and wiring them; the means of protecting them from lightning and abnormal currents; their connection together for operation as series or bridging stations. It is intended for electricians, wiremen, engineers, contractors and all others interested in standard telephone practice.

HERE AND THERE WITH PAUL AND PEGGY. By Florence E. Scott. New York: Hurst & Co., 1914. 16mo.; 320 pp.

JUST PUBLISHED

Pick, Shovel and Pluck

Further Experiences "With the Men Who Do Things"



By A. RUSSELL BOND

Author of "Scientific American Boy," "Scientific American Boy at School," "Handy Man's Workshop and Laboratory," "With the Men Who Do Things."

12mo, (5¾x8¼ inches). Attractively bound in cloth. 255 pages. 110 illustrations, including 58 page-plates and colored frontispiece.

AS the subtitle indicates, this volume is a sequel to "With the Men Who Do Things," which told of two boys who spent a summer in New York, studying the big engineering undertakings in and about the city. The present volume takes the same boys out of New York and gives them a wider variety of engineering experiences, reaching from the Panama Canal to the Keokuk Dam across the Mississippi, and finally bringing them back to New York.

It has been the purpose of the author in explaining the work and struggles of the engineer, to put the material in such simple form that any high-school boy who reads it can understand it, and, if possible, to serve it so appetizingly, that he will continue to read it to the very end. For this reason the material has been woven into a story filled with adventure. Every story in this book, no matter how unreal it may seem, is based on fact. As the primary object of the book is to instruct, every precaution has been taken to secure absolute accuracy of all of the engineering data.

A fascinating and instructive book for boys, relating how many big things in engineering have been accomplished.

INSPIRING CAPTIVATING EDUCATING

Price $1.50 net. Postpaid $1.65.

MUNN & CO., Inc., *Publishers*, 361 Broadway, New York

The Preservation of Wood

OUR forests are growing smaller every day; the supply of timber is rapidly diminishing and its price is constantly increasing. Anything therefore that will promote economy is of vital interest. The preservation of wood, and the prolongation of its useful life is a most practical method of economy, as it not only saves the cost of new material but also avoids the heavy incidental expenses of making the renewals.

Valuable papers on the Preservation of Wood, and the various methods employed, have been published in the Scientific American Supplement from time to time, which cover this important subject quite fully. The list includes the following titles:

Each number of the Supplement costs 10 cents

A set of papers containing all the articles here mentioned will be mailed for $1.80.

Send for a copy of the Supplement Catalogue

Free to any address

The Hasselmann Pickling Process for Mine Timber. By Dr. Max Kraute. Scientific American Supplement No. 1200.

The Rapid Ageing and Fireproofing of Wood. Scientific American Supplement No. 1392.

Preservation of Wood. Scientific American Supplement No. 1440.

A New System of Seasoning Wood with Saccharine or Sugar. Scientific American Supplement No. 1444.

History of Timber Treatment. By Walter W. Curtis. Scientific American Supplement No. 1494.

The Powell Process of Preserving Wood with Saccharine. Scientific American Supplement No. 1636.

The Steaming of Timber. By Octave Chanute. Scientific American Supplement No. 1644.

Wood Preservation. The Meaning of Decay and How It May Be Checked. By W. F. Sherfesee. Scientific American Supplement No. 1700.

Destructive Marine Wood Borers. Various Methods of Protecting Timber Structures. Scientific American Supplement No. 1722.

Fireproofing Wood and Textiles. Scientific American Supplement No. 1752.

Preservative Treatment of Farm Timbers. What Every Farmer Ought to Know. By C. P. Willis. Scientific American Supplement Nos. 1808 and 1809.

How Wood Is Artificially Aged. The Coloration of Wood by Gases and Fumes. By H. Wislicenus. Scientific American Supplement No. 1815.

Development and Status of the Wood Preserving Industry. Notes on the Art as Practiced in America. By E. A. Sterling. Scientific American Supplement No. 1958.

The Preservation of Wood. A Synopsis of the Principal Processes in Use Today. By A. J. Wallis-Taylor. Scientific American Supplement Nos. 2012, 2013 and 2014.

Noden Electrical Process for Rapid Drying and Preserving of Wood. Scientific American Supplement No. 2018.

Order from your Newsdealer or from

MUNN & CO. Inc.

PUBLISHERS

361 BROADWAY

NEW YORK CITY

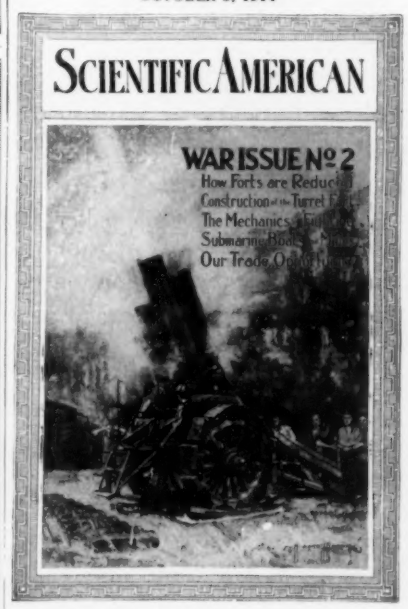
The Three Great War Numbers
OF THE
SCIENTIFIC AMERICAN

WITH SPECIAL TRIAL SUBSCRIPTION OFFER TO THE READERS OF THIS COPY

WAR Issue No. 1 of the Scientific American, published September 5th, is an authoritative handbook of the Great European War, giving exact and detailed information concerning the Armies of all the countries engaged, their comparative strength, armament, signal and telegraph service, medical and ambulance service, etc.

WAR ISSUE No. 1
SEPTEMBER 5, 1914

WAR ISSUE No. 2
OCTOBER 3, 1914



The comparative size and strength of the Navies of the Triple Entente and the Dual Alliance — illustrations of all the types of battleships, cruisers, torpedo boats, etc., of each Navy, together with a description of their guns, calibre, weight, velocity, etc. — aeroplanes and dirigibles of each nation. Illustrated by 110 photographs and War Map in four colors.

War Issues Nos. 1 and 2, together with War Issue No. 3, will give one full and accurate data concerning this great War and the Armies and Navies engaged. Every article is written by an expert and authority.

Each number of the Scientific American, from now until the end of the War, will contain authoritative illustrated articles on the War and the progress of the contending Armies and Navies.

HERE IS AN EXCEPTIONAL OFFER

The three great War Numbers (price 25 cents each) and the Scientific American for four months (16 numbers), all for $1.00

This is a trial subscription offer made especially for those who want to obtain scientific, authoritative and accurate information from week to week regarding this, the greatest War of all time.

CLIP AND FILL IN THE COUPON AT ONCE —send it to us, together with $1.00, money or postal order, and we will send you copies of the War Issues Nos. 1, 2 and 3, and begin your subscription immediately.

DO THIS NOW. YOU WILL WANT TO PRESERVE THESE NUMBERS OF THE SCIENTIFIC AMERICAN.

MUNN & COMPANY, Inc.
361 Broadway New York City

MUNN & Co., Inc.
361 Broadway
New York.

Enclosed find $1.00; send me "Scientific American" for sixteen weeks commencing current issue and copies of War Issues Nos. 1, 2, and 3.

Name.....

Address.....

P. O. .....

State.....

The one big argument for a Studebaker car is the fact that it is a Studebaker car

That includes everything else—the national standing of the name Studebaker inspires confidence in Studebaker products.

"Buy it because it is a Studebaker" is reason enough for the son whose father before him has proven the reliability of Studebaker Products and Studebaker Service.

Hence when Studebaker offers a car like The Studebaker SIX it is little wonder that the public accepts it and recognizes in it the market's greatest value.

It is little wonder that the sales of Studebaker sixes are breaking all records for six-cylinder cars.

It is little wonder that September was the biggest month in the whole Studebaker history—$4,200,000 worth of Studebaker cars sold in that single month.

It is little wonder that the demand continues to push to the utmost limit even Studebaker production.

Studebaker six-cylinder cars are history makers—*history makers.*

November 17, 1912, Studebaker first announced this wonderful automobile bargain: a six-cylindered car for only $1,550! It was more wonderful in 1912 than now, because at that time no other manufacturer had found it possible to offer a six-cylinder car at so low a price.

Since then, Studebaker has continued to be a history maker—

And this year—with the price at $1385—can you find another Six anywhere that approaches it in actual dollar for dollar value?—

Is there another six that measures up to Studebaker quality standards at anywhere near the price?

Because the Studebaker SIX is made part by part by the one great manufacturer of sixes—no parts makers' profits to pay—it offers you great value at a surprisingly low price. Think of the buying power of such a Company, think of the quality of material it can buy and at maximum quantity discounts—Think of the engineering, manufacturing and selling resources of such a Company,—is there another Company that can really compete with Studebaker in the production of cars in the Studebaker SIX class—think, is there a single one?

Motor car buyers are quick to recognize genuine value when they see it—this is the answer to the wonderful Studebaker sales record for this year—The greatest in the history of the Studebaker Company.

Write for the New Studebaker Book—
It is Interesting, Practical and Helpful

STUDEBAKER, Detroit

Studebaker FOUR	$ 985
Studebaker SIX 5-Passenger . . .	1385
Studebaker SIX 7-Passenger . . .	1450

Electric Lighting and Starting—Full Floating Rear Axle—Timken Bearings Throughout—Extra Size Tires—One-Man-Type Top—Left Drive Center Control.